Foreword

This soil survey contains information that can be used in land-planning programs in the survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Lynn A. Brown
State Conservationist
Soil Conservation Service

Soil Survey of
Pend Oreille County Area, Washington

By Norman C. Donaldson, Joseph T. Defrancesco, and Marvin E. Haagen,
Soil Conservation Service; Don W. Barron, Washington Department of Natural Resources; and
Robert G. Coleman, Forest Service

Fieldwork by Norman C. Donaldson, Joseph T. Defrancesco, and Marvin E. Haagen, Soil Conservation Service; Robert A. Klink, Diana Drilica, Robert G. Coleman, Warren Wilson, and Larry Laing, Forest Service; and Don W. Barron, Dave McComb, Larmie D. Edwards, and Jeff Webster, Washington Department of Natural Resources

United States Department of Agriculture, Soil Conservation Service, in
cooperation with
United States Department of Agriculture, Forest Service; Washington State Department of Natural Resources; and Washington State University Agricultural Research Center

General Nature of the Survey Area

PEND OREILLE COUNTY is in the northeastern part of Washington (fig. 1). It borders Idaho on the east, the Canadian Province of British Columbia on the north, Stevens County on the west, and Spokane County on the south. Pend Oreille County has a total area of 912,621 acres, or about 1,426 square miles. Of this total, only 773,394 acres is included in the survey area. The excluded acreage is federally owned land in the Kaniksu National Forest. The major land owners in the survey area are the Forest Service, the State of Washington, the Kalispel Indian Reservation, and the Bureau of Land Management. Newport, the county seat, is about 40 miles northeast of Spokane and 75 miles south of the Canadian border. In 1980, the population of Pend Oreille County was 8,400. The major communities in the county and their populations are Newport, 1,580; lone, 575; Metaline Falls, 305; Cusick, 265; and Metaline, 200.

Pend Oreille County was established by the state legislature in June 1911. Prior to that time, it was part of Stevens County. In 1912, Newport was selected as the county seat (6).

The chief economic enterprises in the county are logging, mining, and farming. The lumber industry relies heavily on timber from federal forests. Most of the merchantable timber is in the foothills and mountains. The major timber species are Douglas fir, western larch, and ponderosa pine. Production in the wood products industry fluctuates in response to changes in demand. Production can be curtailed or stopped by severe

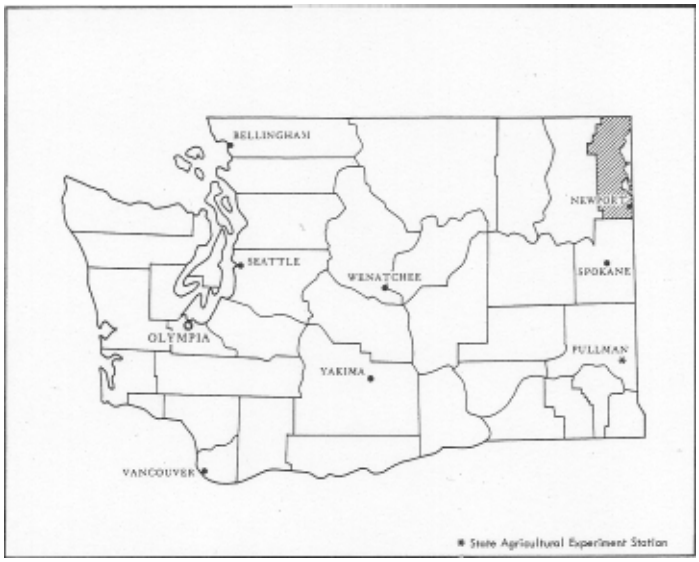

Figure 1.-Location of the Pend Oreille County area in Washington.

winters, wet road and soil conditions in spring, and a severe hazard of fire during the dry summer months. In 1980, about 61 million board feet of timber was harvested in the county.

One of Washington's most important mining areas is the Metaline Mining District, which produces lead, zinc, and silver. In 1963, it was the 12th largest lead and zinc producer in the Nation. The Lehigh Portland Cement Company, which has been in operation since the turn of the century, is located near the Metaline Mining District. The company mines limestone and shale for use in manufacturing cement at its Metaline Falls plant.

The chief farming enterprise in the survey area is the breeding and raising of beef cattle. The area has a few dairy farms. Hay is the primary crop grown for livestock. Oats and barley also are grown for feed. Irrigation increases yields in some areas where water is available.

This survey area has about 53 different kinds of soil. The soils vary widely in texture, natural drainage, and other characteristics.

Soils along the major drainageways are suited to small grain and cereal crops, hay, pasture, recreation, watershed, and wildlife habitat. A seasonal high water table and overflow limit crop production.

Soils on outwash terraces are suited to grain crops, pasture, recreation, timber production, grazable woodland, watershed, and wildlife habitat. The main limitation is a low available water capacity.

Soils on uplands are suited to crops, hay, pasture, timber production, recreation, grazable woodland, watershed, and wildlife habitat. These soils have few limitations. The length of the growing season varies.

Soils on foothills and mountains are best suited to timber production, grazable woodland, recreation, watershed, and wildlife habitat. The main limitations are the slope and a short growing season.

Climate

Prepared by the National Climatic Data Center. Asheville, North Carolina.

In the survey area, summers are warm or hot in most valleys and much cooler in the mountains. Winters are cold in the mountains. Valleys are colder than the lower slopes of the adjacent mountains because of cold air drainage. Precipitation occurs in the mountains throughout the year, and a deep snowpack accumulates during winter. Snowmelt usually supplies much more water than can be used for agriculture in the survey area. In valleys summer precipitation falls during showers and thunderstorms. In winter the ground is covered with snow much of the time. Chinook winds, which blow downslope and are warm and dry, often melt and evaporate the snow.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Boundary Dam in the period 1965 to 1990 and at Newport in the period 1961 to 1991. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 27 or 28 degrees F and the average daily minimum temperature is 20 or 21 degrees. The lowest temperature on record, which occurred at Newport on December 30, 1968, is -37 degrees. In summer, the average temperature is 63 degrees and the average daily maximum temperature is 79 degrees. The highest recorded temperature, which occurred at Newport on August 4, 1961, is 106 degrees.

Growing degree days, shown in table 1, are equivalent to heat units. During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 27 inches. Of this, 9 to 11 inches, or 30 to 40 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 8 inches. The heaviest 1-day rainfall during the period of record was 2.24 inches at Newport on December 18, 1951. Thunderstorms occur on about 11 days each year.

The average seasonal snowfall is about 62 inches at Boundary Dam and 70 inches at Newport. The greatest snow depth at any one time during the period of record was 90 inches. On the average, 75 days of the year at Boundary Dam and 44 days at Newport have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 75 percent of the time possible in summer and 30 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 8 miles per hour, in winter.

Physiography, Relief, and Drainage

Pend Oreille County is part of the Okanogan Highlands. The central and northern parts of the county are characterized by glacially modified foothills and mountains that have deep, narrow valleys. The southern

part is characterized by extensive outwash and glaciolacustrine terraces. The physiographic features in the county are both scenic and diverse. Relief ranges from about 1,900 feet in an area in the southwestern part of the county to 7,309 feet in an area in the northeastern part.

During the ice age, the Colville Lobe of the Cordilleran Ice Sheet extended well beyond the southern boundary of the county. The estimated elevation of the ice sheet was about 5,000 feet at the Canadian border, and the surface sloped to the south 15 to 50 feet per mile (11). At the time of maximum glacial advance, a few high points in the county projected above the ice. As the ice accumulated in the large piedmont glaciers of the Canadian Rockies, it was forced south through the Pend Oreille Valley and its tributary valleys and formed the Spokane Lobe. Upslope movement mitigated the erosive power of the ice as it advanced southward. During the retreat, the formation of recessional lakes and the deposition of material in still water were widespread. Thus, both the main stem of the Pend Oreille Valley and the lower tributaries are characterized by extensive deposits of glaciofluvial material and by depositional landforms.

The Selkirk and Calispell Mountain Ranges make up the major portion of the uplands that are bisected by the north-flowing Pend Oreille River. The Calispell Mountain Range, which is west of the Pend Oreille River, consists of mountain peaks above glacially modified mountainous terrain and foothills. The major peaks and their elevations are the Little Calispell Peak, 5,880 feet; Linton Mountain, 6,215 feet; and Boyer Mountain, 5,252 feet. The east flanks of this range are drained by numerous streams that flow to the east through deep, V-shaped valleys into the Pend Oreille River. One major road and two minor roads cross the mountains at an elevation of about 3,500 feet.

The Selkirk Mountain Range, which is on the east side of the Pend Oreille River, is characterized by many deep, narrow valleys and steep mountain side slopes. The most prominent peaks and their elevations are Salmo Mountain, 6,828 feet; Molybdenite Mountain, 6,784 feet; Sullivan Mountain, 6,483 feet; Grassy Top Mountain, 6,253 feet; South Baldy Mountain, 5,961 feet; and Monumental Mountain, 5,700 feet. These peaks are aligned along their crests and form part of the eastern boundary of the survey area. The streams originating in this mountain range drain either west into the Pend Oreille River or east toward Idaho as part of the Priest Lake watershed. Few roads traverse this rugged region.

Sullivan Lake is a conspicuous glacial feature in the northeastern part of the county. The lake formed in a glacial depression that was oriented north to south and paralleled the direction of ice flow. It is about 1,300 acres in size and has a normal pool elevation of 2,588 feet.

The Pend Oreille River and its tributaries dominate the drainage system in the county. The Pend Oreille River flows into the county from the east near Newport, then flows west and northwest for about 10 miles, and then flows north, entering Canada near the center of the north county line. At Newport, the normal pool elevation of the river is 2,031 feet. Behind Boundary Dam it is 1,990 feet, and at the Canadian line it is 1,722 feet. The Pend Oreille Valley is narrow for the size of the river. Recent alluvial sediments are deposited on nearly level to undulating lakebeds and low terraces along the river. The sides of the Pend Oreille Valley are gently sloping to steep. They are made up of glacial drift, residuum and colluvium, and rock outcrops.

The Cusick Basin, which includes Calispell Lake, has stratified, silty and clayey sediments that were seasonally deposited in a large, still glacial lake. Glacial lake deposits are in other parts of the county, along drainageways in areas where glacial meltwater was ponded.

Broad glacial outwash terraces are south of the Cusick Basin. They formed as flooding glacial meltwater deposited sand and gravel. The terraces are generally low in relief and have occasional escarpments with slopes of more than 40 percent. Davis, Diamond, and Sacheen Lakes are examples of the lakes in areas of these terraces. The streams that drain these areas flow south into the Little Spokane River.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind or segment of the

landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape; a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge gradually onto one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size, and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The soils or miscellaneous areas making up one unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils or miscellaneous areas can be identified on the map. Likewise, areas that are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Some soil boundaries and soil names do not fully match those in surveys of adjoining areas that were published at an earlier date. Differences result from changes and refinements in series concepts, variations in slope classes, and application of the latest soil classification system.

The general map units in this survey have been grouped into general kinds of landscape for broad interpretive purposes. Each of the broad groups and the map units in each group are described in the following pages.

Map Unit Descriptions

Soils on Mountains and Foothills

These soils make up about 79 percent of the survey area. They are nearly level to very steep. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation generally is 2,000 to 6,500 feet, but some peaks are at higher elevations. The average annual precipitation is 25 to 55 inches, the average annual air temperature is 39 to 44 degrees F, and the average frost-free period is 70 to 120 days.

These soils are moderately deep and very deep and are well drained. They formed in material weathered from granitic rock, shale, phyllite, igneous rock, and quartzite and in glacial till. The residuum and the till are mixed with or mantled by volcanic ash and loess.

These soils are used mainly for grazable woodland or for commercial trees. They also are used for recreation, watershed, wildlife habitat, homesite development, and nonirrigated crops.

1. Moscow-Rock Outcrop-Prouty

Rock outcrop and moderately deep, well drained, nearly level to very steep soils formed in residuum and colluvium that are derived dominantly from granitic rock and are mixed with or mantled by volcanic ash and loess; on foothills and mountains

This map unit is mainly in the southern and western parts of the survey area. It is characterized by rounded ridgetops and convex side slopes. Drainageways are deeply dissected. Slope is 0 to 65 percent. The vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,200 to 6,500 feet. The average annual precipitation is 27 to 55 inches, the average annual air temperature is 40 to 44 degrees F, and the average growing season (at 28 degrees) is 70 to 100 days.

This unit makes up about 15 percent of the survey area. It is about 45 percent Moscow soils, 14 percent Rock outcrop, 8 percent Prouty soils, and 33 percent soils of minor extent.

Moscow soils are mainly on north- and east-facing slopes at the lower elevations and south- and west-facing slopes at the higher elevations. These soils formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from granitic rock. The surface is covered with a mat of organic material. The surface layer and the upper part of the subsoil are silt loam. The lower part of the subsoil is gravelly sandy loam. Weathered granitic rock is at a depth of about 27 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Rock outcrop consists mainly of areas of exposed granitic rock.

Prouty soils are mainly on north- and east-facing slopes. They formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from granitic rock. The surface is covered with a mat of organic material. The surface layer is extremely bouldery silt loam. The upper part of the subsoil is gravelly silt loam, and the lower part is gravelly sandy loam. The substratum is very gravelly sandy loam. Weathered granitic rock is at a depth of about 28 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Of minor extent in this unit are Brickel soils, the shallow Mobate and Skanid soils, the deep Moso and Vassar soils, and Usk soils.

This unit is used mainly for commercial trees or grazable woodland. It also is used for wildlife habitat, recreation, watershed, and homesite development. Small areas are used for nonirrigated crops. In the areas used for homesite development, the main limitations are the slope, the depth to bedrock, and the Rock outcrop.

2. Huckleberry-Hartill-Buhrig

Moderately deep, well drained, nearly level to very steep soils formed mainly in residuum and colluvium that are derived dominantly from phyllite and quartzite rock and are mixed with or mantled by volcanic ash and loess; on foothills and mountains

This map unit is throughout the survey area. The largest acreage is north and east of the Pend Oreille River. The landscape is characterized by sharp ridgetops and steep, convex side slopes. Drainageways are deeply dissected. Slope is 0 to 65 percent. The vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation generally is 2,000 to 6,500 feet, but in a few small areas it is more than 6,500 feet. The average annual precipitation is 27 to 45 inches, the average annual air temperature is 39 to 44 degrees F, and the average growing season (at 28 degrees) is 70 to 110 days.

This unit makes up about 24 percent of the survey area. It is about 25 percent Huckleberry soils, 19 percent Hartill soils, 16 percent Buhrig soils, and 40 percent soils of minor extent.

Huckleberry soils are mainly on north- and east-facing slopes. They formed in a mantle of volcanic ash and loess over colluvium and residuum derived dominantly from phyllite and quartzite. The surface is covered with a mat of organic material. When mixed to a depth of 5 inches, the surface layer is silt loam. The subsoil also is silt loam. The upper part of the substratum is channery loam, and the lower part is very flaggy loam. Phyllite is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches.

Hartill soils are mainly on north- and east-facing slopes at the lower elevations and on south- and west-facing slopes at elevations of more than 3,000 feet. These soils formed in a mantle of volcanic ash and loess over colluvium and residuum derived dominantly from phyllite and quartzite. The surface is covered with a mat of organic material. When mixed to a depth of 8 inches, the surface layer is silt loam. The subsoil also is silt loam. The upper part of the substratum is channery loam, and the lower part is very channery loam. Phyllite is at a depth of about 36 inches. The depth to bedrock ranges from 20 to 40 inches.

Buhrig soils are mainly on shoulder slopes, back slopes, and the tops of mountains. They formed in a mantle of volcanic ash and loess and in residuum and colluvium derived dominantly from metasedimentary and igneous rock. The surface is covered with a mat of organic material. The surface layer is very stony loam. The upper part of the subsoil is extremely stony loam, and the lower part is extremely stony sandy loam. The substratum also is extremely stony sandy loam. Fractured quartzite is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches.

Of minor extent in this unit are Belzar, Ojibway, Prouty Variant, and Raisio soils; the shallow Rufus soils; the deep Vassar soils that have a channery substratum; Rubble land; and Rock outcrop.

This unit is used mainly for commercial trees or grazable woodland. It also is used for recreation, wildlife habitat, watershed, and homesite development. Small areas are used for nonirrigated crops. In the areas used for homesite development, the main limitations are the slope, the depth to bedrock, and large stones.

3. Boundary-Sherlock-Waits

Very deep, well drained, nearly level to very steep soils formed in calcareous glacial till mixed with or mantled by volcanic ash or loess; on foothills and mountains

This map unit is in the northern part of the survey area. It is characterized by glacially smoothed slopes. Slope is 0 to 65 percent. The vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,200 feet. The average annual precipitation is 25 to 50 inches, the average annual air temperature is 40 to 44 degrees F, and the average growing season (at 28 degrees) is 60 to 110 days.

This unit makes up about 4 percent of the survey area. It is about 23 percent Boundary soils, 18 percent Sherlock soils, 17 percent Waits soils, and 42 percent soils of minor extent.

Boundary soils formed in calcareous glacial till mantled with volcanic ash. The surface is covered with a mat of organic material. When mixed to a depth of 10 inches, the surface layer is silt loam. The subsoil is very gravelly silt loam and very gravelly silty clay loam. The substratum to a depth of 60 inches or more is very gravelly silty clay loam.

Sherlock soils formed in glacial till of mixed mineralogy and in a mantle of volcanic ash. The surface is covered with a mat of organic material. When mixed to a depth of 9 inches, the surface layer is silt loam. The upper part of the subsoil is very gravelly silt loam. The lower part to a depth of 60 inches or more is very gravelly silty clay loam.

Waits soils formed in calcareous glacial till mantled with volcanic ash and loess. The surface is covered with a mat of organic material. When mixed to a depth of about 7 inches, the surface layer is loam. The upper part of the subsoil is silt loam, and the lower part is gravelly loam. The substratum to a depth of 60 inches or more is gravelly loam.

Of minor extent in this unit are Ahren, Smackout, and Threemile soils.

This unit is used mainly for grazable woodland or for commercial trees. It also is used for recreation, wildlife habitat, watershed, and homesite development. Small areas are used for nonirrigated crops. In the areas used for homesite development, the main limitations are moderately slow permeability and the slope,

4. Newbell-Manley-Aits

Very deep, well drained, nearly level to very steep soils formed in glacial till that is of mixed mineralogy and is mantled with volcanic ash and loess; on foothills and mountains

This map unit is widely distributed throughout the survey area. It is characterized by glacially smoothed slopes. Slope is 0 to 65 percent. The vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 6,500 feet. The average annual precipitation is 25 to 45 inches, the average annual air temperature is 40 to 44 degrees F, and the average growing season (at 28 degrees) is 80 to 120 days.

This unit makes up about 36 percent of the survey area. It is about 39 percent Newbell soils, 24 percent Manley soils, 12 percent Aits soils, and 25 percent soils of minor extent.

Newbell soils formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. The surface is covered with a mat of organic material. The surface layer and subsoil are silt loam. The substratum to a depth of 60 inches or more is very gravelly sandy loam.

Manley soils formed in glacial till that is of mixed mineralogy and is mantled with a thick layer of volcanic ash. When mixed to a depth of 8 inches, the surface layer is silt loam. The subsoil also is silt loam. The substratum to a depth of 60 inches or more is very gravelly sandy loam.

Aits soils formed in glacial till that is of mixed mineralogy and is mantled with volcanic ash and loess. The surface is covered with a mat of organic material. When mixed to a depth of 6 inches, the surface layer is loam. The upper part of the subsoil also is loam. The lower part is gravelly loam. The substratum to a depth of 60 inches or more is gravelly loam.

Of minor extent in this unit are the poorly drained Aquolls; Conto, Conto Variant, Inkler, Merkel, Smackout, and Smackout Variant soils; Cryands; the Rock outcrop-Orthents complex; and the Xerochrepts-Aquic Xerofluvents complex. Also of minor extent are a few areas of Boundary and Waits soils.

This unit is used for grazable woodland or for commercial trees. It also is used for recreation, wildlife habitat, watershed, and homesite development. Small areas are used for nonirrigated crops. In the areas used for homesite development, the main limitations are the slope and moderately slow permeability in some areas.

Soils on Terraces, on Terrace Escarpments, and in Basins

These soils make up about 18 percent of the survey area. They are nearly level to very steep. The native vegetation is mainly conifers, forbs, shrubs, and grasses. Elevation is 2,000 to 4.500 feet. The average annual precipitation is 22 to 35 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is 90 to 120 days.

These soils are very deep and are well drained, moderately well drained, and somewhat poorly drained. They formed in glacial lake sediments and glacial outwash that in most areas are mixed with or mantled by volcanic ash and loess.

These soils are used mainly for grazable woodland, nonirrigated and irrigated crops, recreation, watershed, wildlife habitat, or homesite development.

5. Cusick-Martella-Anglen

Very deep, somewhat poorly drained and moderately well drained, nearly level to steep soils formed in glacial lake sediments that in most areas are mixed with or mantled by volcanic ash or loess; in basins, on terraces, and on terrace escarpments

This map unit is mainly adjacent to the Pend Oreille River and in the Calispell Basin. It is characterized by

broad, gently undulating to hilly slopes that are occasionally broken by short, steep slopes. Slope is 0 to 40 percent. The vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 22 to 30 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

This unit makes up about 5 percent of the survey area. It is about 29 percent Cusick soils, 26 percent Martella soils, 21 percent Anglen soils, and 24 percent soils of minor extent.

Cusick soils are in nearly level basins. They are somewhat poorly drained. They formed in glacial lake sediments. In some areas the surface is covered with a mat of organic material. The surface layer is silty clay loam. The subsoil and the upper part of the substratum are mottled silty clay. The lower part of the substratum to a depth of 60 inches or more is mottled very fine sandy loam.

Martella soils are on nearly level to moderately steep terraces and steep terrace escarpments. They are moderately well drained. They formed in glacial lake sediments mantled with volcanic ash and loess. The surface is covered with a mat of organic material. When mixed to a depth of 7 inches, the surface layer is silt loam. The upper part of the subsoil also is silt loam. The lower part is very fine sandy loam. The substratum to a depth of 60 inches or more is laminated clay loam.

Anglen soils are on nearly level to strongly sloping terraces. They are moderately well drained. They formed in glacial lake sediments mantled with volcanic ash and loess. The surface is covered with a mat of organic material. The surface layer is silt loam. The subsurface layer is very fine sandy loam. The upper part of the subsoil is silty clay loam and silt loam. The lower part to a depth of 60 inches or more is silty clay loam.

Of minor extent in this unit are the well drained Clayton soils and the moderately well drained Dalkena soils.

This unit is used mainly for grazable woodland or for nonirrigated and irrigated crops. It also is used for recreation, homesite development, watershed, and wildlife habitat. In the areas used for homesite development, the main limitations are very slow and moderately slow permeability, a perched seasonal high water table, and the slope.

6. Bonner-Orwig-Kaniksu

Very deep, well drained, nearly level to very steep soils formed in glacial outwash that is of mixed mineralogy and has an admixture or mantle of volcanic ash or loess; on terraces and terrace escarpments

This map unit is mainly along drainageways throughout the survey area and is widely distributed in the southern part of the area. It is characterized by broad, nearly level to moderately steep slopes that are occasionally broken by short, very steep slopes. Slope is 0 to 65 percent. The vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

This unit makes up about 13 percent of the survey area. It is about 23 percent Bonner soils, 17 percent Orwig soils, 13 percent Kaniksu soils, and 47 percent soils of minor extent.

Bonner soils are on nearly level to moderately sloping terraces. They formed in a mantle of volcanic ash and loess over glacial outwash of mixed mineralogy. The surface is covered with a mat of organic material. When mixed to a depth of 6 inches, the surface layer is silt loam or gravelly silt loam. The upper part of the subsoil also is silt loam or gravelly silt loam. The lower part is gravelly loam. The substratum to a depth of 60 inches or more is very gravelly loamy sand.

Orwig soils are on nearly level to moderately steep terraces and nearly level to very steep terrace escarpments. They formed in sandy glacial outwash derived dominantly from granitic rock. The outwash has an admixture of volcanic ash and loess in the upper part. The surface is covered with a mat of organic material. When mixed to a depth of 4 inches, the surface layer is sandy loam. The subsoil also is sandy loam. The upper part of the substratum is loamy sand, and the lower part to a depth of 60 inches or more is gravelly sand.

Kaniksu soils are on nearly level to moderately steep terraces and moderately steep to steep terrace escarpments. They formed in sandy glacial outwash of mixed mineralogy. The outwash has an admixture of volcanic ash and loess in the upper part. The surface is covered with a mat of organic material. The surface layer and subsoil are sandy loam. The substratum to a depth of 60 inches or more is gravelly loamy sand.

Of minor extent in this unit are Dufort, Eloika, Kiehl, Roaring, Scotia, and Scrabblers soils; the somewhat excessively drained Sacheen soils; and Typic Xerorthents.

This unit is used mainly for grazable woodland. It also is used for nonirrigated and irrigated crops,

recreation, homesite development, watershed, and wildlife habitat. In the areas used for homesite development, the main limitations are a poor filtering capacity on sites for septic tank absorption fields, the instability of cutbanks, and the slope.

Soils on Flood Plains and in Lake Basins

These soils make up about 3 percent of the survey area. They are nearly level. The vegetation is mainly deciduous trees, conifers, forbs, shrubs, and water-tolerant grasses. Elevation is 2,000 to 4.000 feet. The average annual precipitation is 22 to 35 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is 80 to 110 days.

These soils are very deep and are somewhat poorly drained and very poorly drained. They formed in alluvium and muck.

These soils are used mainly for nonirrigated and irrigated crops, hay and pasture, or grazable woodland. They also are used for homesite development, recreation, wildlife habitat, and watershed.

7. Kegel-Blueslide-Uncas

Very deep, somewhat poorly drained and very poorly drained, nearly level soils formed in alluvium and muck mixed with volcanic ash; on flood plains and in lake basins

This map unit is mainly in the southern half of the survey area. Slope is 0 to 3 percent. The native vegetation is grasses, forbs, shrubs, conifers, and deciduous trees. Elevation is 2.000 to 4,000 feet. The average annual precipitation is 22 to 35 inches, the average annual air temperature is 44 degrees F, and the average growing season (at 28 degrees) is 80 to 100 days.

This unit makes up about 3 percent of the survey area. It is about 28 percent Kegel soils, 26 percent Blueslide soils, 14 percent Uncas soils, and 32 percent soils of minor extent.

Kegel soils are on flood plains. They are somewhat poorly drained. They formed in alluvium. The surface is covered with a mat of organic material. The surface layer is loam. The upper part of the underlying material is mottled gravelly sandy loam. The next part is mottled sandy loam. The lower part to a depth of 60 inches or more is mottled very gravelly sandy loam.

Blueslide soils are on flood plains. They are somewhat poorly drained. They formed in alluvium. The surface layer is silt loam. The upper part of the underlying material is mottled silt loam. The next part is mottled fine sandy loam. The lower part to a depth of 60 inches or more is mottled silt loam.

Uncas soils are on flood plains and in old lake basins. They are very poorly drained. They formed in muck and alluvium derived dominantly from volcanic ash. The upper part of the surface layer is muck. The lower part of the surface layer, the subsoil, and the substratum to a depth of 60 inches or more are mottled silt loam.

Of minor extent in this unit are Borosaprists, the poorly drained Hoodoo soils, Pywell soils, the well drained Rathdrum soils, Riverwash, and Sacheen Variant and Uncas Variant soils.

This unit is used mainly for nonirrigated and irrigated crops, hay and pasture, or grazable woodland. It also is used for watershed, wildlife habitat, recreation, and homesite development. In the areas used for homesite development, the main limitations are a seasonal high water table, the hazard of flooding, and moderately slow permeability in some areas.

Broad Land Use Considerations

The soils in the survey area vary widely in their potential for major land uses. Approximately 4 percent of the area is used for cultivated crops, mainly wheat, barley, oats, grasses, and legume hay (alfalfa and red clover). The cropland is in scattered areas throughout the county but is concentrated largely in map units 3, 4, 5, 6, and 7. The soils in map unit 7 are occasionally flooded in winter and spring. The flooding causes slight or moderate crop damage in the lowest areas. Wetness is a major limitation if the soils in this unit are used for crops. Erosion and seasonal wetness are the main limitations in map unit 5. Erosion is the main hazard in map units 3 and 4. Erosion and the available water capacity are the main limitations in map unit 6.

Approximately 2 percent of the survey area is used as pasture. Map units 5 and 7 have high potential for grasses and legumes. Grazing should be restricted early in spring, when the soils in these units are saturated.

About 20 percent of the survey area is used as grazable woodland. Map units 1, 2, 3, 4, 5, and 6 can be used for grazing and browsing as well as for timber production. The productivity varies, depending on stand density and management of the woodland and understory vegetation. Grazing and logging should be limited early in spring, when the soils are saturated.

About 7,600 acres in the survey area is used as urban or built-up land. The built-up land is mainly in the areas in map units 5 and 6 along the Pend Oreille River and in the areas around the many lakes in the survey area. If the soils in map unit 5 are used for homesite development, the main limitations are moderately slow or very slow permeability, frost action, and the shrink-swell potential. If the soils in map unit 6 are used for

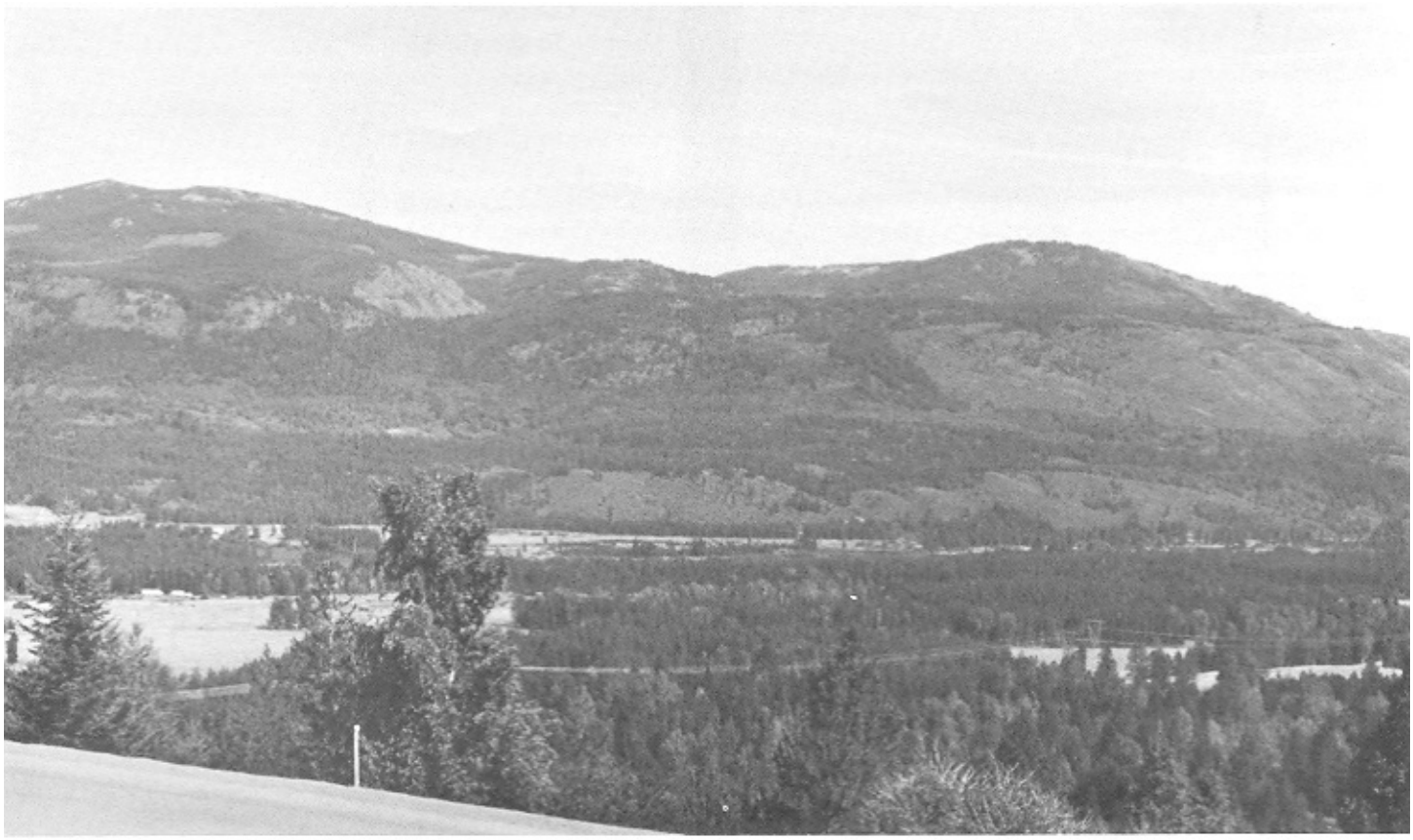

Figure 2.-An area of woodland near lone. Molybdenite Mountain is in the background.

homesite development, the main limitations are seepage, the instability of cutbanks, and the slope.

The potential for recreational uses ranges from low to high throughout the survey area, depending on the intensity of the expected use and the properties of the soils. Most of the soils in map units 5 and 6 have high potential for intensive recreational uses, such as campgrounds and picnic areas. Many of the lakes, rivers, and streams in the survey area are in areas of these map units. Map unit 7 has low potential for intensive recreational uses because of flooding. Map units 1, 2, 3, and 4 are limited as sites for these uses because of Me slope. Small areas of soils that are suitable for intensive recreational uses are available in all of the map units in the survey area. All of the units are suitable for extensive recreational uses, such as skiing, hiking, horseback riding, motorcycling, snowmobiling, and hunting.

About 90 percent of the survey area is used for timber production (fig. 2). The productivity in areas of conifers is low to high. Map units 3, 4, and 5 can produce the largest volume of wood. Map unit 6 also can produce a large volume of wood. Most of the woodland is grazed by livestock in spring, summer, or fall and by big game animals throughout the year. Plant competition generally is the main management concern. After a stand is logged, tree establishment may be set back several years because undesirable plants invade and native plants temporarily compete with the trees. All of the steeper soils in the county are subject to erosion, which should be taken into consideration when harvesting activities are planned.

Detailed Soil Map Units

The map units delineated on the detailed maps at the back of this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit is given under "Use and Management of the Soils."

A map unit delineation on a map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation is needed to precisely define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series.* Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Aits loam, high precipitation, 40 to 65 percent slopes, is a phase of the Aits series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are called complexes. A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of

the soils or miscellaneous areas are somewhat similar in all areas. Aits, high precipitation-Rock outcrop complex, 40 to 65 percent slopes, is an example.

This survey includes *miscellaneous areas.* Such areas have little or no soil material and support little or no vegetation. Riverwash is an example.

Some soil boundaries and soil names do not fully match those in surveys of adjoining areas that were published at an earlier date. Differences result from changes and refinements in series concepts, variations in slope classes, and application of the latest soil classification system.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The "Glossary" defines many of the terms used in describing the soils or miscellaneous areas.

Map Unit Descriptions

1-Ahren loam, 2 to 20 percent slopes. This very deep, well drained soil is on the toe slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over calcareous, fine textured glacial till derived dominantly from shaly rock and limestone. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,800 feet. The average annual precipitation is 27 to 32 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is brown loam about 3 inches thick. The upper 7 inches of the subsoil is yellowish brown loam. The lower 27 inches is light gray gravelly silty clay loam. The substratum to a depth of 60 inches or more is light gray very gravelly silty clay loam.

Included in this unit are small areas of Ahren loam that has a slope of less than 2 percent or more than 20 percent, Aits loam, Smackout loam, and Waits loam. Also included are Belzar silt loam, Boundary silt loam, and Hartill silt loam on the upper parts of the slopes; Rock outcrop on knobs; and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Ahren soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 81. The highest average growth rate for Douglas fir is 83 cubic feet per acre per year at age 96. Based on a 50-year site curve, the mean site index for western larch is 62. The highest average growth rate for western larch is 85 cubic feet per acre per year at age 70. The typical basal area of trees is about 70 percent of that in normal stands of Douglas fir and western larch. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly common snowberry, pachystima, mallow ninebark, kinnikinnick, pinegrass, Douglas maple, huckleberry, rose, Oregongrape, creambush oceanspray, thimbleberry, hazelnut, and ceanothus. Overgrazing causes the desirable plants, such as pinegrass, mallow ninebark, rose, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated barley and grass-legume hay. The main management concerns are the hazard of water erosion and the slope. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture,

maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions or terraces may be needed to control erosion on cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

The main limitations on homesites are the slope and the shrink-swell potential. Special designs for buildings may be needed to overcome the slope. Properly designing foundations and footings and diverting runoff away from buildings can help to prevent the structural damage caused by shrinking and swelling.

The main limitations on sites for septic tank absorption fields are the slope and the moderately slow permeability. Where the slope is less than 15 percent, the absorption fields can function properly if the absorption lines are installed on the contour as needed. The absorption fields do not function properly on the steeper slopes. As a result, the effluent can surface in downslope areas and create a health hazard. Backfilling the trench with sandy material and enlarging the absorption field can help to compensate for the moderately slow permeability.

The capability subclass is IIIe, nonirrigated.

2-Ahren loam, 20 to 40 percent slopes. This very deep, well drained soil is on the foot slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over calcareous, fine textured glacial till derived dominantly from shaly rock and limestone. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,800 feet. The average annual precipitation is 27 to 32 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is brown loam about 3 inches thick. The upper 7 inches of the subsoil is yellowish brown loam. The lower 27 inches is light gray gravelly silty clay loam. The substratum to a depth of 60 inches or more is light gray very gravelly silty clay loam.

Included in this unit are small areas of Ahren loam that has a slope of less than 20 percent or more than 40 percent, Aits loam, Smackout loam, and Waits loam. Also included are Belzar silt loam, Boundary silt loam, and Hartill silt loam on the upper parts of the slopes; Rock outcrop on knobs; and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Ahren soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 81. The highest average growth rate for Douglas fir is 83 cubic feet per acre per year at age 100. Based on a 50-year site curve, the mean site index for western larch is 62. The highest average growth rate for western larch is 85 cubic feet per acre per year at age 70. The typical basal area of trees is about 70 percent of that in normal stands of Douglas fir and western larch. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, ceanothus, common snowberry, huckleberry, creambush oceanspray, pachystima, mallow ninebark, kinnikinnick, Douglas maple, rose, Oregongrape, thimbleberry, and hazelnut. Overgrazing causes the desirable plants, such

as pinegrass, mallow ninebark, rose, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting is the most effective seeding method.

The main limitations on homesites are the slope and the shrink-swell potential. Special designs for buildings may be needed to overcome the slope. Properly designing foundations and footings and diverting runoff away from buildings can help to prevent the structural damage caused by shrinking and swelling.

Septic tank absorption fields do not function properly because of the slope and the moderately slow permeability. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is VIe, nonirrigated.

3-Ahren loam, 40 to 65 percent slopes. This very deep, well drained soil is on the back slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over calcareous, fine textured glacial till derived dominantly from shaly rock and limestone. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,800 feet. The average annual precipitation is 27 to 32 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is brown loam about 3 inches thick. The upper 7 inches of the subsoil is yellowish brown loam. The lower 27 inches is light gray gravelly silty clay loam. The substratum to a depth of 60 inches or more is light gray very gravelly silty clay loam.

Included in this unit are small areas of Ahren loam that has a slope of less than 40 percent or more than 65 percent, Aits loam, Smackout loam, and Waits loam. Also included are Belzar silt loam, Boundary silt loam, and Hartill silt loam on the upper parts of the slopes; Rock outcrop on ridges and knobs; and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Ahren soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 81. The highest average growth rate for Douglas fir is 83 cubic feet per acre per year at age 100. Based on a 50-year site curve, the mean site index for western larch is 62. The highest average growth rate for western larch is 85 cubic feet per acre per year at age 70. The typical basal area of trees is about 70 percent of that in normal stands of Douglas fir and western larch. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, ceanothus, common snowberry, huckleberry, creambush oceanspray, pachystima, mallow ninebark, kinnikinnick, Douglas maple, rose, Oregongrape, thimbleberry, and hazelnut. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Overgrazing causes the desirable plants, such as pinegrass, mallow ninebark, rose, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIe, nonirrigated.

4-Aits loam, high precipitation, 0 to 15 percent slopes. This very deep, well drained soil is on the toe slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,000 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1/2 inch thick. When mixed to a depth of about 6 inches, the surface layer is brown loam. The upper 6 inches of the subsoil is light brown loam. The lower 18 inches is very pale brown gravelly loam. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

Included in this unit are small areas of Aits loam that has a slope of more than 15 percent, Newbell silt loam, Smackout loam, and Waits loam. Also included are Bonner silt loam and Martella silt loam on terrace remnants, Hartill silt loam on the upper parts of the slopes, Inkler gravelly silt loam on south- and west-facing slopes, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

Permeability is moderately slow in this Aits soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 88. The highest average growth rate for Douglas fir is 99 cubic feet per acre per year at age 91. Based on a 50-year site curve, the mean site index for western larch is 75. The highest average growth rate for western larch is 111 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 123. The highest average growth rate for ponderosa pine is 148 cubic feet per acre per year at age 40. The typical basal area of trees is about 75 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly creambush oceanspray, pinegrass, common snowberry, rose, Douglas maple, Oregongrape, mallow ninebark, white spirea, kinnikinnick, Saskatoon serviceberry, ceanothus, and pachystima. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, Saskatoon serviceberry, rose, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated wheat, barley, oats, and grass-legume hay. The main management concerns are the hazard of water erosion and the slope. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions or terraces may be needed to control erosion on cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

The main limitation on homesites is the slope. Special designs for buildings may be needed to overcome the slope.

The main limitations on sites for septic tank absorption fields are the slope and the moderately slow permeability. Where the slope is a concern, the absorption lines should be installed on the contour.

Backfilling the trench with sandy material and enlarging the absorption fields can help to compensate for the moderately slow permeability.

The capability subclass is IIIe, nonirrigated.

5-Aits loam, high precipitation, 15 to 25 percent slopes. This very deep, well drained soil is on the toe slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,000 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1/2 inch thick. When mixed to a depth of about 6 inches, the surface layer is brown loam. The upper 6 inches of the subsoil is light brown loam. The lower 18 inches is very pale brown gravelly loam. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

Included in this unit are small areas of Aits loam that has a slope of less than 15 percent or more than 25 percent, Newbell silt loam, Smackout loam, and Waits loam. Also included are Bonner silt loam and Martella silt loam on terrace remnants, Hartill silt loam on the upper parts of the slopes, Inkler gravelly silt loam on south- and west-facing slopes, poorly drained soils in draws and adjacent to seeps and springs, and Rock outcrop on knobs. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Aits soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated crops. homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 88. The highest average growth rate for Douglas fir is 99 cubic feet per acre per year at age 91. Based on a 50-year site curve, the mean site index for western larch is 75. The highest average growth rate for western larch is 111 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 123. The highest average growth rate for ponderosa pine is 148 cubic feet per acre per year at age 40. The typical basal area of trees is about 75 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly creambush oceanspray, pinegrass, common snowberry, rose, Douglas maple, Oregongrape, mallow ninebark, white spirea, kinnikinnick, Saskatoon serviceberry, ceanothus, and pachystima. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, Saskatoon serviceberry, rose, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated wheat, barley, oats, and grass-legume hay. The main management concerns are the hazard of water erosion and the slope. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming and stripcropping may be needed to control erosion on cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed

waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 years of small grain.

The main limitation on homesites is the slope. Special designs for buildings may be needed to overcome the slope.

Septic tank absorption fields do not function properly because of the slope and the moderately slow permeability. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is IVe, nonirrigated.

6-Aits loam, high precipitation, 25 to 40 percent slopes. This very deep, well drained soil is on the foot slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,000 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1/2 inch thick. When mixed to a depth of about 6 inches, the surface layer is brown loam. The upper 6 inches of the subsoil is light brown loam. The lower 18 inches is very pale brown gravelly loam. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

Included in this unit are small areas of Aits loam that has a slope of less than 25 percent or more than 40 percent, Newbell silt loam, Smackout loam, and Waits loam. Also included are Bonner silt loam and Martella silt loam on terrace remnants, Hartill silt loam on the upper parts of the slopes, Inkler gravelly silt loam on south- and west-facing slopes, poorly drained soils in draws and adjacent to seeps and springs, and Rock outcrop on knobs. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Aits soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 88. The highest average growth rate for Douglas fir is 99 cubic feet per acre per year at age 91. Based on a 50-year site curve, the mean site index for western larch is 75. The highest average growth rate for western larch is 111 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 123. The highest average growth rate for ponderosa pine is 148 cubic feet per acre per year at age 40. The typical basal area of trees is about 75 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly creambush oceanspray, pinegrass, common snowberry, rose, Douglas maple, Oregongrape, mallow ninebark, white spirea, kinnikinnick, Saskatoon serviceberry, ceanothus, and pachystima. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, Saskatoon serviceberry, rose, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the

slope. Broadcasting is the most effective seeding method.

The main limitation on homesites is the slope. Special designs for buildings may be needed to overcome the slope.

Septic tank absorption fields do not function properly because of the slope and the moderately slow permeability. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is VIe, nonirrigated.

7-Aits loam, high precipitation, 40 to 65 percent slopes. This very deep, well drained soil is on the back slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,000 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1/2 inch thick. When mixed to a depth of about 6 inches, the surface layer is brown loam. The upper 6 inches of the subsoil is light brown loam. The lower 18 inches is very pale brown gravelly loam. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

Included in this unit are small areas of Aits loam that has a slope of less than 40 percent or more than 65 percent, Newbell silt loam, Smackout loam, and Waits loam. Also included are Hartill silt loam on the upper parts of the slopes, Inkler gravelly silt loam on south- and west-facing slopes, poorly drained soils in draws and adjacent to seeps and springs, and Rock outcrop on ridges and knobs. Included areas make up about 15 percent of the unit.

Permeability is moderately slow in this Aits soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 88. The highest average growth rate for Douglas fir is 99 cubic feet per acre per year at age 91. Based on a 50-year site curve, the mean site index for western larch is 75. The highest average growth rate for western larch is 111 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 123. The highest average growth rate for ponderosa pine is 148 cubic feet per acre per year at age 40. The typical basal area of trees is about 75 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly creambush oceanspray, pinegrass, common snowberry, rose, Douglas maple, Oregongrape, mallow ninebark, white spirea, kinnikinnick, Saskatoon serviceberry, ceanothus, and pachystima. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, Saskatoon serviceberry, rose, and mallow ninebark, to decrease in extent and the less desirable plants to increase. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIe, nonirrigated.

8-Aits stony loam, high precipitation, 0 to 40 percent slopes. This very deep, well drained soil is on the toe slopes and foot slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,000 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1/2 inch thick. When mixed to a depth of about 6 inches, the surface layer is brown stony loam. The upper 6 inches of the subsoil is light brown stony loam. The lower 18 inches is very pale brown gravelly loam. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

Included in this unit are small areas of Aits stony loam that has a slope of more than 40 percent, Newbell stony silt loam, Smackout loam, and Waits loam. Also included are Hartill silt loam on the upper parts of the slopes, Inkler gravelly silt loam on south- and west-facing slopes, poorly drained soils in draws and adjacent to seeps and springs, and Rock outcrop on knobs. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Aits soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 88. The highest average growth rate for Douglas fir is 99 cubic feet per acre per year at age 91. Based on a 50-year site curve, the mean site index for western larch is 75. The highest average growth rate for western larch is 111 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 123. The highest average growth rate for ponderosa pine is 148 cubic feet per acre per year at age 40. The typical basal area of trees is about 75 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the stones, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The stones on the surface can hinder harvesting. Also, falling timber can break on the stones.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly creambush oceanspray, pinegrass, common snowberry, rose, Douglas maple, Oregongrape, mallow ninebark, white spirea, kinnikinnick, Saskatoon serviceberry, ceanothus, and pachystima. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, Saskatoon serviceberry, rose, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope and the stones on the surface. Broadcasting is the most effective seeding method.

The main limitation on homesites is the slope. Special designs for buildings may be needed to overcome the slope.

The main limitations on sites for septic tank absorption fields are the slope and the moderately slow permeability. Where the slope is less than 15 percent, the absorption fields can function properly if the absorption lines are installed on the contour as needed. The absorption fields cannot function properly on the steeper slopes. As a result, the effluent can surface in downslope areas and create a health hazard. Backfilling

the trench with sandy material and enlarging the absorption fields can help to compensate for the moderately slow permeability.

The capability subclass is VIe, nonirrigated.

9-Aits stony loam, high precipitation, 40 to 65 percent slopes. This very deep, well drained soil is on the back slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,000 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1/2 inch thick. When mixed to a depth of about 6 inches, the surface layer is brown stony loam. The upper 6 inches of the subsoil is light brown stony loam. The lower 18 inches is very pale brown gravelly loam. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

Included in this unit are small areas of Aits stony loam that has a slope of less than 40 percent or more than 65 percent, Newbell stony silt loam, Smackout loam, and Waits loam. Also included are Hartill silt loam on the upper parts of the slopes, Inkler gravelly silt loam on south- and west-facing slopes, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Aits soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 88. The highest average growth rate for Douglas fir is 99 cubic feet per acre per year at age 91. Based on a 50-year site curve, the mean site index for western larch is 75. The highest average growth rate for western larch is 111 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 123. The highest average growth rate for ponderosa pine is 148 cubic feet per acre per year at age 40. The typical basal area of trees is about 75 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are the stones and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The stones on the surface can hinder harvesting. Also, falling timber can break on the stones.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly creambush oceanspray, pinegrass, common snowberry, rose, Douglas maple, Oregongrape, mallow ninebark, white spirea, kinnikinnick, Saskatoon serviceberry, ceanothus, and pachystima. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, Saskatoon serviceberry, rose, and mallow ninebark, to decrease in extent and the less desirable plants to increase. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope and the stones on the surface. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIe, nonirrigated.

10-Aits, high precipitation-Rock outcrop complex, 0 to 40 percent slopes. This map unit is on the toe slopes and foot slopes of foothills and mountains. Slopes are convex and generally have north and east aspects at the lower elevations and south and west

aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,000 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

This unit is about 70 percent Aits stony loam, high precipitation, 0 to 40 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Aits stony loam that has a slope of more than 40 percent, Newbell stony silt loam, Smackout loam, and Waits loam. Also included are Hartill silt loam on the upper parts of the slopes, Inkler gravelly silt loam on south- and west-facing slopes, Kegel loam adjacent to the main drainageways, very stony and very shallow soils near the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 10 percent of the unit.

This Aits soil is very deep and well drained. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Typically, the surface is covered with a mat of organic material about 1/2 inch thick. When mixed to a depth of about 6 inches, the surface layer is brown stony loam. The upper 6 inches of the subsoil is light brown stony loam. The lower 18 inches is very pale brown gravelly loam. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

Permeability is moderately slow in the Aits soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

The Rock outcrop consists mainly of exposed granitic rock, quartzite, and shale.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 88. The highest average growth rate for Douglas fir is 99 cubic feet per acre per year at age 91. Based on a 50-year site curve, the mean site index for western larch is 75. The highest average growth rate for western larch is 111 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 123. The highest average growth rate for ponderosa pine is 148 cubic feet per acre per year at age 40. The typical basal area of trees is about 75 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the Rock outcrop, the stones, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop and the stones on the surface can hinder harvesting. Also, falling timber can break on the Rock outcrop and the stones.

Steep skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed.

This unit is suited to grazing and browsing. The forest understory is mainly creambush oceanspray, pinegrass, common snowberry, rose, Douglas maple, Oregongrape, mallow ninebark, white spirea, kinnikinnick, Saskatoon serviceberry, ceanothus, and pachystima. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, Saskatoon serviceberry, rose, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope, the Rock outcrop, and the stones on the surface. Broadcasting is the most effective seeding method.

The Aits soil is in capability subclass Vle, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

11-Aits, high precipitation-Rock outcrop complex, 40 to 65 percent slopes. This map unit is on the back slopes of foothills and mountains. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,000 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

This unit is about 70 percent Aits stony loam, high precipitation, 40 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Aits stony loam that has a slope of less than 40 percent or more than 65 percent, Newbell stony silt loam, Smackout loam, and Waits loam. Also included are Hartill silt loam on the upper parts of the slopes, Inkler gravelly silt loam on south- and west-facing slopes, Kegel loam adjacent to the main drainageways, very stony and very shallow soils near the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 10 percent of the unit.

This Aits soil is very deep and well drained. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Typically, the surface is covered with a mat of organic material about 1/2 inch thick. When mixed to a depth of about 6 inches, the surface layer is brown stony loam. The upper 6 inches of the subsoil is light brown stony loam. The lower 18 inches is very pale brown gravelly loam. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

Permeability is moderately slow in the Aits soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

The Rock outcrop consists mainly of exposed granitic rock, quartzite, and shale.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on the Aits soil. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 88. The highest average growth rate for Douglas fir is 99 cubic feet per acre per year at age 91. Based on a 50-year site curve, the mean site index for western larch is 75. The highest average growth rate for western larch is 111 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 123. The highest average growth rate for ponderosa pine is 148 cubic feet per acre per year at age 40. The typical basal area of trees on the Aits soil is about 75 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are the Rock outcrop, the stones, and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop and the stones on the surface can hinder harvesting. Also, falling timber can break on the Rock outcrop and the stones.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed.

This unit is suited to grazing and browsing. The forest understory is mainly creambush oceanspray, pinegrass, common snowberry, rose, Douglas maple, Oregongrape, mallow ninebark, white spirea, kinnikinnick, Saskatoon serviceberry, ceanothus, and pachystima. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, Saskatoon serviceberry, rose, and mallow ninebark, to decrease in extent and the less desirable plants to increase. A uniform distribution of grazing by domestic livestock is unlikely because of the slope and the Rock outcrop. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage.

Seedbed preparation and seeding are hindered by the Rock outcrop, the stones on the surface, and the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Aits soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

12-Anglen silt loam, 0 to 7 percent slopes. This very deep, moderately well drained soil is on terraces. It formed in a mantle of volcanic ash and loess over fine textured glacial lake sediments. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,100 to 3,000 feet. The average annual precipitation is 27 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 11 inches, the surface layer is pale brown silt loam. The subsurface layer is light gray very fine sandy loam about 10 inches thick. The upper 9 inches of the subsoil is 60 percent brown silty clay loam and 40 percent light gray silt loam. The next 17 inches is light yellowish brown silty clay loam. The lower part to a depth of 60 inches or more is light olive gray silty clay loam.

Included in this unit are small areas of Anglen silt loam that has a slope of more than 7 percent, Dalkena fine sandy loam, Kaniksu sandy loam, Martella silt loam, Sacheen loamy fine sand, and Scotia fine sandy loam. Also included are Blueslide silt loam in depressions and adjacent to streams and poorly drained soils in depressions. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Anglen soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. A perched seasonal high water table is at a depth of 2.5 to 3.5 feet from December through April.

This unit is used for grazable woodland, nonirrigated and irrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, grand fir, ponderosa pine, lodgepole pine, and western white pine are the main woodland species on this unit. Based on a 50-year site curve, the mean site index for Douglas fir is 80. The highest average growth rate for Douglas fir is 81 cubic feet per acre per year at age 97. Based on a 100-year site curve, the mean site index for ponderosa pine is 120. The highest average growth rate for ponderosa pine is 141 cubic feet per acre per year at age 40. The typical basal area of trees is about 80 percent of that in normal stands of Douglas fir and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western larch and grand fir have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes the formation of ruts and compaction. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, grand fir, ponderosa pine, lodgepole pine, and western white pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, western larch, or ponderosa pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly Oregongrape, pinegrass, alder, common snowberry, thimbleberry, bluegrass, ceanothus, pachystima, mountain brome, rose, willow, and creambush oceanspray. Overgrazing causes the desirable plants, such as pinegrass, rose, mountain brome, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated and irrigated wheat, barley, oats, and grass-legume hay. The main management concerns are the seasonal wetness and the hazard of water erosion. Minimum tillage helps to prevent compaction. A tillage pan forms if the soil is tilled when wet. In some years spring planting is delayed because of the wetness. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Stripcropping and diversions or terraces may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume

hay, such as alfalfa, and 2 or 3 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

The main limitations on homesites are the shrink-swell potential and the seasonal wetness. Properly designing foundations and footings and diverting runoff away from buildings can help to prevent the structural damage caused by shrinking and swelling. A drainage system is needed on sites for buildings with basements and crawl spaces because of the perched seasonal high water table.

The main limitations on sites for septic tank absorption fields are the moderately slow permeability and the seasonal wetness. Installing interceptor drains, adding topsoil, and installing longer absorption lines on the contour help to compensate for these limitations.

The capability subclass is IIIe, irrigated and nonirrigated.

13-Anglen silt loam, 7 to 15 percent slopes. This very deep, moderately well drained soil is on terraces. It formed in a mantle of volcanic ash and loess over fine textured glacial lake sediments. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,100 to 3,000 feet. The average annual precipitation is 27 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 11 inches, the surface layer is pale brown silt loam. The subsurface layer is light gray very fine sandy loam about 10 inches thick. The upper 9 inches of the subsoil is 60 percent brown silty clay loam and 40 percent light gray silt loam. The next 17 inches is light yellowish brown silty clay loam. The lower part to a depth of 60 inches or more is light olive gray silty clay loam.

Included in this unit are small areas of Anglen silt loam that has a slope of less than 7 percent or more than 15 percent, Dalkena fine sandy loam, Kaniksu sandy loam, Martella silt loam, Scotia fine sandy loam, and Sacheen loamy fine sand. Also included are Blueslide silt loam in depressions and adjacent to streams and poorly drained soils in depressions. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Anglen soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. A perched seasonal high water table is at a depth of 2.5 to 3.5 feet from December through April.

This unit is used for grazable woodland, nonirrigated and irrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, grand fir, ponderosa pine, lodgepole pine, and western white pine are the main woodland species on this unit. Based on a 50-year site curve, the mean site index for Douglas fir is 80. The highest average growth rate for Douglas fir is 81 cubic feet per acre per year at age 97. Based on a 100-year site curve, the mean site index for ponderosa pine is 120. The highest average growth rate for ponderosa pine is 141 cubic feet per acre per year at age 40. The typical basal area of trees is about 80 percent of that in normal stands of Douglas fir and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western larch and grand fir have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, grand fir, ponderosa pine, lodgepole pine, and western white pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, western larch, or ponderosa pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly Oregongrape, pinegrass, alder, common snowberry, thimbleberry, bluegrass, ceanothus, pachystima, mountain brome, rose, willow, and creambush oceanspray. Overgrazing causes the desirable plants, such as pinegrass, rose, mountain brome, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated and irrigated wheat, barley, oats, and grass-legume hay. The main

management concerns are the seasonal wetness, the hazard of water erosion, and the slope. Minimum tillage helps to prevent compaction. A tillage pan forms if the soil is tilled when wet. In some years spring planting is delayed because of the wetness. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. Some areas are seepy. A common cropping system is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

The main limitations on homesites are the slope, the shrink-swell potential, and the seasonal wetness. Special designs for buildings may be needed to overcome the slope. Properly designing foundations and footings and diverting runoff away from buildings can help to prevent the structural damage caused by shrinking and swelling. A drainage system is needed on sites for buildings with basements and crawl spaces because of the perched seasonal high water table.

The main limitations on sites for septic tank absorption fields are the slope, the moderately slow permeability, and the seasonal wetness. Where the slope is a concern, the absorption lines should be installed on the contour. Installing interceptor drains, adding topsoil, and installing longer absorption lines on the contour help to compensate for the limitations of this soil.

The capability subclasses are IVe, irrigated, and IIIe, nonirrigated.

14-Aquolls, 5 to 40 percent slopes. These very deep, poorly drained soils are adjacent to the midslope drainageways of foothills and mountains. They formed in alluvium, colluvium, volcanic ash, and loess. Slopes are concave. The native vegetation is mainly hardwoods, conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 27 to 45 inches, the average annual air temperature is about 41 degrees F, and the average growing season (at 28 degrees) is 60 to 120 days.

No single profile is typical of these soils. In one commonly observed in the survey area, however, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is dark grayish brown and grayish brown gravelly loam about 12 inches thick. The upper 28 inches of the underlying material is light gray gravelly loam. The lower part to a depth of 60 inches or more is light brownish gray, mottled gravelly loam. The texture, color, and thickness of the layers of these soils vary widely from one area to another and occasionally within short distances. In some areas the surface layer is silt loam, gravelly silt loam, or gravelly loam. In places the underlying material is very gravelly loam or very gravelly sandy loam.

Included in this unit are small areas of Aquolls that have a slope of less than 5 percent or more than 40 percent, Aits loam, Inkler gravelly silt loam, Newbell silt loam, Manley silt loam, Merkel stony sandy loam, and Prouty Variant silt loam. Because the Aquolls occur throughout a wide geographic area, not all of the inclusions are likely to occur in each mapped area. Included areas make up about 20 percent of the unit.

Permeability is moderate in the Aquolls. Available water capacity also is moderate. The effective rooting depth is limited by a seasonal high water table that is within a depth of 1.5 feet from February through June. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Quaking aspen is the main woodland species on this unit. Among the trees of limited extent are paper birch, western redcedar, and willow. Based on a 80-year site curve, the estimated mean site index for quaking aspen is 50. The highest average growth rate for quaking aspen is 20 cubic feet per acre per year at age 80.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soils are moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soils are dry. Puddling can occur when the soils are wet. Low-pressure ground equipment damages the soils less severely than conventional equipment and thus helps to maintain productivity. Roads constructed on this unit require additional rock to improve the ability of the soils to support equipment. When wet, skid trails are soft and slippery and can be impassable. The seasonal high water table restricts the use of equipment to periods when the soils are dry in the upper part or when they are protected by snowpack. Occasional snowpack hinders the use of equipment in winter.

Steep skid trails, firebreaks, and other disturbed

areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by quaking aspen occurs periodically. Reforestation can be accomplished by planting western redcedar seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and prevent the establishment of natural and planted reforestation species. The seasonal high water table, which hinders root respiration, may result in a low seedling survival rate. Because the rooting depth is restricted by the seasonal high water table, the trees are frequently subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly sedge, rush, spirea, common snowberry, and redtop. Overgrazing causes the desirable plants, such as sedge and redtop, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the seasonal wetness and the slope. Broadcasting is the most effective seeding method.

The capability subclass is Vlw, nonirrigated.

15-Belzar silt loam, high precipitation, 20 to 40 percent slopes. This moderately deep, well drained soil is on the foot slopes and ridgetops of foothills and mountains. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from calcareous rock and limestone. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 5,500 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 80 to 100 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is brown silt loam about 7 inches thick. The upper 6 inches of the subsoil also is brown silt loam. The lower 7 inches is brown channery loam. The substratum is pale brown very channery loam about 15 inches thick. Fractured limestone is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Belzar silt loam that has a slope of less than 20 percent or more than 40 percent, Ahren loam, Aits loam, Boundary silt loam, Hartill silt loam, and Waits loam. Also included are Rock outcrop on ridges and knobs and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Belzar soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 78. The highest average growth rate for Douglas fir is 77 cubic feet per acre per year at age 98. The typical basal area of trees is about 80 percent of that in a normal stand of Douglas fir. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, creambush oceanspray, common snowberry, Douglas maple, Saskatoon serviceberry, thimbleberry, pachystima,

spirea, Oregongrape, kinnikinnick, and ceanothus. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, Saskatoon serviceberry, and rose, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting is the most effective seeding method.

The main limitations on homesites are the slope and the depth to bedrock. Special designs for buildings may be needed to overcome the slope. The cuts needed to provide essentially level building sites can expose the bedrock.

Septic tank absorption fields cannot function properly because of the slope and the depth to bedrock. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is Vle, nonirrigated.

16-Belzar silt loam, high precipitation, 40 to 65 percent slopes. This moderately deep, well drained soil is on the back slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from calcareous rock and limestone. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 5,500 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 80 to 100 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is brown silt loam about 7 inches thick. The upper 6 inches of the subsoil also is brown silt loam. The lower 7 inches is brown channery loam. The substratum is pale brown very channery loam about 15 inches thick. Fractured limestone is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Belzar silt loam that has a slope of less than 40 percent or more than 65 percent, Ahren loam, Aits loam, Boundary silt loam, Hartill silt loam, and Waits loam. Also included are Rock outcrop on ridges and knobs and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Belzar soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 78. The highest average growth rate for Douglas fir is 77 cubic feet per acre per year at age 98. The typical basal area of trees is about 80 percent of that in a normal stand of Douglas fir. Per acre productivity is reduced accordingly.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, creambush oceanspray, common snowberry, Douglas maple, Saskatoon serviceberry, thimbleberry, rose, pachystima, spirea, Oregongrape, kinnikinnick, and ceanothus. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, Saskatoon serviceberry, and rose, to decrease in extent and the less desirable plants to increase. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting with aerial or hand

equipment is the most effective seeding method. The capability subclass is VIIe, nonirrigated.

17-Belzar, high precipitation-Rock outcrop complex, 5 to 40 percent slopes. This map unit is on the toe slopes, foot slopes, and ridgetops of foothills and mountains. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 5,500 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 80 to 100 days.

This unit is about 65 percent Belzar silt loam, high precipitation, 5 to 40 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Belzar silt loam that has a slope of less than 5 percent or more than 40 percent, Ahren loam, Aits loam, Boundary silt loam, Hartill silt loam, and Waits loam. Also included are very stony and very shallow soils near the Rock outcrop and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

This Belzar soil is moderately deep and well drained. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from calcareous rock and limestone. Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is brown silt loam about 7 inches thick. The upper 6 inches of the subsoil also is brown silt loam. The lower 7 inches is brown channery loam. The substratum is pale brown very channery loam about 15 inches thick. Fractured limestone is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Belzar soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

The Rock outcrop consists mainly of exposed calcareous shale or limestone.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on the Belzar soil. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 78. The highest average growth rate for Douglas fir is 77 cubic feet per acre per year at age 98. The typical basal area of trees on the Belzar soil is about 80 percent of that in a normal stand of Douglas fir, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the Rock outcrop, and the slope, which hinders the use of skidding equipment. Using standard wheeled or tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, creambush oceanspray, common snowberry, Douglas maple, Saskatoon serviceberry, thimbleberry, rose, pachystima, spirea, Oregongrape, kinnikinnick, and ceanothus. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, Saskatoon serviceberry, and rose, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the Rock outcrop and the slope. Broadcasting is the most effective seeding method.

The Belzar soil is in capability subclass VIe, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

18-Belzar, high precipitation-Rock outcrop complex, 40 to 65 percent slopes. This map unit is on the back slopes and ridgetops of foothills and mountains. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 5,500 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 80 to 100 days.

This unit is about 65 percent Belzar silt loam, high precipitation, 40 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Belzar silt loam that has a slope of less than 40 percent ormore than 65 percent, Ahren loam, Aits loam, Boundary silt loam, Hartill silt loam, and Waits loam. Also included are very stony and very shallow soils near the Rock outcrop and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up 15 percent of the unit.

This Belzar soil is moderately deep and well drained. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from calcareous rock and limestone. Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is brown silt loam about 7 inches thick. The upper 6 inches of the subsoil also is brown silt loam. The lower 7 inches is brown channery loam. The substratum is pale brown very channery loam about 15 inches thick. Fractured limestone is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Belzar soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed calcareous shale or limestone.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on the Belzar soil. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 78. The highest average growth rate for Douglas fir is 77 cubic feet per acre per year at age 98. The typical basal area of trees on the Belzar soil is about 80 percent of that in a normal stand of Douglas fir, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are the Rock outcrop and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, creambush oceanspray, common snowberry, Douglas maple, Saskatoon serviceberry, thimbleberry, rose, pachystima, spirea, Oregongrape, kinnikinnick, and ceanothus. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, Saskatoon serviceberry, and rose, to decrease in extent and the less desirable plants to increase. A uniform distribution of grazing by domestic livestock is unlikely because of the slope and the Rock outcrop. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope and the Rock outcrop. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Belzar soil is in capability subclass VIIe,

nonirrigated. The Rock outcrop is in capability subclass VIIIs.

19-Blueslide silt loam. This very deep, somewhat poorly drained soil is on flood plains. It formed in alluvium derived dominantly from granitic rock, lacustrine sediments, volcanic ash, and loess. Slope is 0 to 3 percent. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 80 to 100 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface layer is grayish brown silt loam about 10 inches thick. The subsurface layer is gray silt loam about 4 inches thick. The upper 16 inches of the underlying material is light gray, mottled silt loam. The next 6 inches is light brownish gray, mottled silt loam. The next 10 inches is light brownish gray, mottled fine sandy loam. The lower part to a depth of 60 inches or more is light brownish gray, mottled silt loam.

Included in this unit are small areas of Cusick silty clay loam, Dalkena fine sandy loam, Hoodoo silt loam, Kegel loam, Pywell muck, and Rathdrum very fine sandy loam. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in the Blueslide soil. Available water capacity is high. The effective rooting depth is limited by a seasonal high water table at a depth of 0.5 foot to 3.0 feet from February through April. The soil is subject to frequent, brief periods of flooding from February through April. Runoff is very slow, and the hazard of water erosion is slight.

This unit is used for grazable woodland, nonirrigated and irrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Ponderosa pine and Douglas fir are the main woodland species on this unit. Among the trees of limited extent is lodgepole pine. Based on a 100-year site curve, the mean site index for ponderosa pine is 99. The highest average growth rate for ponderosa pine is 100 cubic feet per acre per year at age 40.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. If roads are constructed on this unit, additional rock is needed to improve the ability of the soil to support equipment. When wet, unsurfaced roads and skid trails are sticky and slippery and can be impassable. The seasonal high water table restricts the use of equipment to periods when the soil is dry in the upper part or is protected by snowpack. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine and Douglas fir occurs periodically. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and can prevent the establishment of natural and planted reforestation species. The flooding and the seasonal high water table, which hinder root respiration, may result in a low seedling survival rate. Because the rooting depth is restricted by the seasonal high water table, the trees are frequently subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly tufted hairgrass, sedge, Oregongrape, Saskatoon serviceberry, common snowberry, reed canarygrass, redtop, rush, willow, spirea, rose, and hawthorn. Overgrazing causes the desirable plants, such as tufted hairgrass, redtop, rose, and sedge, to decrease in extent and the less desirable plants to increase. Wetness can limit access by livestock. Compaction occurs in areas that are grazed or browsed when the soil is wet. Seeding suitable plants in recently disturbed areas can help to provide desirable forage. Seedbed preparation and seeding are hindered by the seasonal wetness. Seeding with ground equipment, such as a range drill, and broadcasting are the most effective seeding methods.

This unit is suited to nonirrigated and irrigated wheat, barley, oats, and grass-legume hay. The main management concerns are the seasonal wetness and the hazard of flooding. Tile drains and open ditches have been used in most areas to remove excess surface and subsurface water where suitable outlets are available. Minimum tillage helps to prevent compaction. A tillage pan forms if the soil is tilled when wet. In some years spring planting is delayed because of the wetness. The risk of flooding can be reduced by protective levees, dikes, and diversions. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture and maintain good tilth. A common crop rotation is 4 to 8 years of grass-legume hay, such as clover, and 2 years of grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive

irrigation and leaching of plant nutrients.

The main management concerns on homesites are the hazard of flooding and the seasonal wetness. Dikes and channels can protect the homesites from flooding. Buildings and roads should be constructed above the expected level of flooding. Tile drains and open ditches can lower the water table if suitable outlets are available.

Septic tank absorption fields cannot function properly because of the seasonal wetness, the hazard of flooding, and the moderately slow permeability. Also, the effluent can contaminate ground water.

The capability subclass is IIIw, irrigated and nonirrigated.

20-Bonner silt loam, 0 to 10 percent slopes. This very deep, well drained soil is on terraces. It formed in a mantle of volcanic ash and loess over glacial outwash of mixed mineralogy. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,200 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 120 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 6 inches, the surface layer is brown silt loam. The upper 6 inches of the subsoil is light brown silt loam. The lower 12 inches is very pale brown gravelly loam. The substratum to a depth of 60 inches or more is very pale brown very cobbly loamy sand. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Included in this unit are small areas of Bonner silt loam that has a slope of more than 10 percent, Bonner gravelly silt loam, Dufort silt loam, Kaniksu sandy loam, and Kiehl gravelly silt loam. Also included is Rathdrum very fine sandy loam in depressions. Included areas make up about 15 percent of the unit.

Permeability is moderate to a depth of 24 inches in this Bonner soil and rapid below that depth. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for grazable woodland, nonirrigated and irrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, ponderosa pine, western larch, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent is grand fir. Based on a 50-year site curve, the mean site index for Douglas fir is 84. The highest average growth rate for Douglas fir is 90 cubic feet per acre per year at age 94. Based on a 100-year site curve, the mean site index for ponderosa pine is 112. The highest average growth rate for ponderosa pine is 126 cubic feet per acre per year at age 40. The typical basal area of trees is about 80 percent of that in normal stands of Douglas fir and ponderosa pine. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, western larch, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. The survival rate of naturally established Douglas fir and ponderosa pine seedlings may be low if the silt loam in the surface layer and in the upper part of the subsoil has been displaced by logging.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, kinnikinnick, rose, common snowberry, Oregongrape, pachystima, white spirea, creambush oceanspray, strawberry, huckleberry, mallow ninebark, and Douglas maple. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, mallow ninebark, and rose, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated and irrigated wheat, barley, oats, and grass-legume hay. The main management concerns are the low available water capacity, the hazard of water erosion, and the slope. The crops that are tolerant of drought grow best. The amount of available moisture is not adequate for most other crops to grow well. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain

good tilth, and control erosion. Stripcropping and diversions or terraces may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

The main limitations on homesites are the slope and the instability of cutbanks. Special designs for buildings may be needed to overcome the slope. The sides of shallow excavations can cave in unless they are supported by special retainer walls.

The main limitations on sites for septic tank absorption fields are the slope and the rapid permeability in the substratum. Because of the slope, the absorption lines should be installed on the contour. Seepage from the absorption fields can contaminate ground water because of the rapid permeability.

The capability subclass is IIIs, irrigated, and IVs, nonirrigated.

21-Bonner gravelly silt loam, 0 to 10 percent slopes. This very deep, well drained soil is on terraces. It formed in a mantle of volcanic ash and loess over glacial outwash of mixed mineralogy. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,200 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 120 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 6 inches, the surface layer is brown gravelly silt loam. The upper 6 inches of the subsoil is light brown gravelly silt loam. The lower 12 inches is very pale brown gravelly loam. The substratum to a depth of 60 inches or more is very pale brown very cobbly loamy sand. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Included in this unit are small areas of Bonner gravelly silt loam that has a slope of more than 10 percent, Bonner silt loam, Dufort silt loam, Kaniksu sandy loam, and Kiehl gravelly silt loam. Also included is Rathdrum very fine sandy loam in depressions. Included areas make up about 15 percent of the unit.

Permeability is moderate to a depth of 24 inches in this Bonner soil and rapid below that depth. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for grazable woodland, nonirrigated and irrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, ponderosa pine, western larch, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent is grand fir. Based on a 50-year site curve, the mean site index for Douglas fir is 84. The highest average growth rate for Douglas fir is 90 cubic feet per acre per year at age 94. Based on a 100-year site curve, the mean site index for ponderosa pine is 112. The highest average growth rate for ponderosa pine is 126 cubic feet per acre per year at age 40. The typical basal area of trees is about 80 percent of that in normal stands of Douglas fir and ponderosa pine. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, western larch, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. The survival rate of naturally established Douglas fir and ponderosa pine seedlings may be low if the gravelly silt loam in the surface layer and in the upper part of the subsoil has been displaced by logging. This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, kinnikinnick, rose, common snowberry, Oregongrape, pachystima, white spirea, creambush oceanspray, strawberry, huckleberry, mallow ninebark, and Douglas maple. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, mallow ninebark, and rose, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable

forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated and irrigated wheat, barley, oats, and grass-legume hay. The main management concerns are the low available water capacity, the hazard of water erosion, and the slope. The crops that are tolerant of drought grow best. The amount of available moisture is not adequate for most other crops to grow well. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Stripcropping and diversions or terraces may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

The main limitations on homesites are the slope and the instability of cutbanks. Special designs for buildings may be needed to overcome the slope. The sides of shallow excavations can cave in unless they are supported by special retainer walls.

The main limitations on sites for septic tank absorption fields are the slope and the rapid permeability in the substratum. Because of the slope, the absorption lines should be installed on the contour. Seepage from the absorption fields can contaminate ground water because of the rapid permeability.

The capability subclass is IIIs, irrigated, and IVs, nonirrigated.

22-Borosaprists, ponded. These very deep, very poorly drained soils are in upland basins and on the perimeter of lakes and beaver ponds. They formed in organic material over alluvium derived dominantly from volcanic ash. Slope is 0 to 2 percent. The native vegetation is mainly wetland forbs and grasses, including rushes, sedges, cattails, and reeds. Elevation is 2,000 to 3,500 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 41 degrees F, and the average growing season (at 28 degrees) is 60 to 110 days.

No single profile is typical of these soils. In one commonly observed in the survey area, however, the surface layer is black muck about 12 inches thick. The next 28 inches is dark brown and light olive brown muck. Below this to a depth of 60 inches or more is light gray; mottled very fine sandy loam. The texture, color, and thickness of the layers of these soils vary widely from one area to another and occasionally within short distances. The depth to mineral material ranges from 16 to more than 60 inches. This material is sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, or silty clay loam.

Permeability is moderate. Available water capacity is very high. The effective rooting depth is limited by a seasonal high water table that is 1 foot above the surface from October through June. Runoff is ponded, and water erosion typically is not a hazard.

This unit is used for watershed and wildlife habitat. It provides good habitat for waterfowl. In summer, when the water table is below the surface, livestock graze in some areas.

The capability subclass is Vllw, nonirrigated.

23-Boundary silt loam, 0 to 30 percent slopes. This very deep, well drained soil is on the toe slopes and foot slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over calcareous, fine textured glacial till. Slopes are plane or complex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 4,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 10 inches, the surface layer is yellowish brown silt loam. The upper part of the subsoil is light yellowish brown very gravelly silt loam about 5 inches thick. The next part is pale olive very gravelly silty clay loam about 6 inches thick. The lower part is olive and pale olive very gravelly silt loam about 19 inches thick. The substratum to a depth of 60 inches or more is light olive gray very gravelly silty clay loam. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Included in this unit are small areas of Boundary silt loam that has a slope of more than 30 percent, Ahren loam, and Threemile silt loam. Also included is Belzar silt loam on the upper parts of the slopes and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Boundary soil. Available water capacity is moderate. The effective

rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated crops, homesite development, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 77. The highest average growth rate for Douglas fir is 75 cubic feet per acre per year at age 99. The typical basal area of trees is about 90 percent of that in a normal stand of Douglas fir. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly Oregongrape, pachystima, rose, creambush oceanspray, Lewis mockorange, mallow ninebark, strawberry, common snowberry, huckleberry, and white spirea. Overgrazing causes the desirable plants, such as mallow ninebark, rose, Lewis mockorange, and crearbush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated wheat, barley, and legume hay. The main management concerns are the hazard of water erosion and the slope. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions or terraces may be needed to control erosion on cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

The main limitation on homesites is the slope. Special designs for buildings may be needed to overcome the slope.

The main limitations on sites for septic tank absorption fields are the slope and the moderately slow permeability. Where the slope is less than 15 percent, the absorption fields can function properly if the absorption lines are installed on the contour as needed. The absorption fields cannot function properly on the steeper slopes. As a result, the effluent can surface in downslope areas and create a health hazard. Backfilling the trench with sandy material and enlarging the absorption fields can help to compensate for the moderately slow permeability.

The capability subclass is IVe, nonirrigated.

24-Boundary silt loam, 30 to 65 percent slopes. This very deep, well drained soil is on the back slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over calcareous, fine textured glacial till. Slopes are plane or complex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 4,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is about 44 degrees F, and the average growing season (28 degrees F) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 10 inches, the surface layer is yellowish brown silt loam. The upper part of the subsoil is light yellowish brown very gravelly silt loam about 5 inches thick. The next part is pale olive very gravelly silty clay loam about 6 inches thick. The lower part is olive and pale olive very gravelly silt loam about 19 inches thick. The substratum to a depth of 60 inches or more is light olive gray very gravelly silty clay loam. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Included in this unit are small areas of Boundary silt loam that has a slope of less than 30 percent or more than 65 percent, Ahren loam, and Threemile silt loam. Also included are Belzar silt loam and Hartill silt loam on the upper parts of the slopes. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Boundary soil. Available water capacity is moderate. The effective

rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 77. The highest average growth rate for Douglas fir is 75 cubic feet per acre per year at age 99. The typical basal area of trees is about 90 percent of that in a normal stand of Douglas fir. Per acre productivity is reduced accordingly.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade, and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly Oregongrape, pachystima, rose, creambush oceanspray, Lewis mockorange, mallow ninebark, strawberry, common snowberry, huckleberry, and white spirea. Overgrazing causes the desirable plants, such as mallow ninebark, rose, Lewis mockorange, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIe, nonirrigated.

25-Brickel stony loam, 20 to 60 percent slopes. This moderately deep, well drained soil is on the shoulder slopes and ridgetops of mountains. It formed in residuum and colluvium derived dominantly from granitic rock. The residuum and colluvium have an admixture of volcanic ash and loess. Slopes are convex and generally have south and west aspects. The native vegetation is mainly shrubs, forbs, and grasses. Elevation is 5,000 to 7,000 feet. The average annual precipitation is 35 to 45 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 60 to 80 days.

Typically, the surface layer is grayish brown stony loam about 13 inches thick. The subsoil is brown very stony loam about 10 inches thick. The substratum is pale brown very stony sandy loam about 13 inches thick. Fractured granite is at a depth of about 36 inches. The depth to bedrock ranges from 20 to 40 inches (fig. 3).

Included in this unit are small areas of Brickel stony loam that has a slope of less than 20 percent or more than 60 percent and Buhrig very stony loam. Also included are Buhrig soils that are very bouldery or extremely bouldery at the surface and Rock outcrop on ridges and knobs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Brickel soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for rangeland, recreation, watershed, and wildlife habitat.

This unit is suitable as rangeland. The vegetation is mainly common beargrass, sedge, bluebunch wheatgrass, eriogonum, and mountainash. Overgrazing causes the desirable plants, such as common beargrass, bluebunch wheatgrass, and sedge, to decrease in extent and the less desirable plants to increase. A uniform distribution of grazing is unlikely because of the slope. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the stones on the surface and by the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIe, nonirrigated.

26-Brickel-Rock outcrop complex, 20 to 60 percent slopes. This map unit is on the shoulder slopes and ridgetops of mountains. Slopes are convex and generally have south and west aspects. The native vegetation is mainly shrubs, forbs, and grasses. Elevation is 5,000 to 7,000 feet. The average annual precipitation is 35 to 45 inches, the average annual air

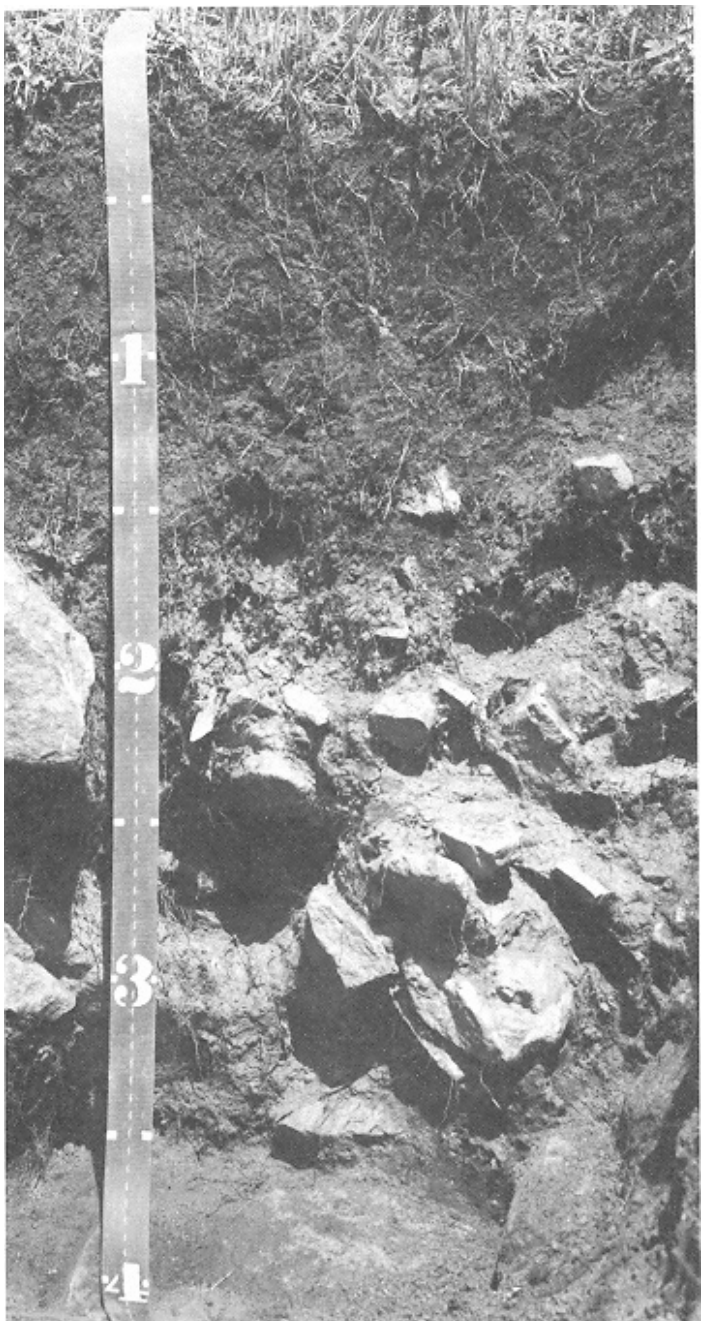

Figure 3.-Profile of Brickel stony loam, 20 to 60 percent slopes. This soil is moderately deep to granite. Depth is marked in feet.

temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 60 to 80 days.

This unit is about 70 percent Brickel stony loam, 20 to 60 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Brickel stony loam that has a slope of less than 20 percent or more than 60 percent and Buhrig very stony loam. Also included are Buhrig soils that are very bouldery or extremely bouldery at the surface and very stony and very shallow soils near the Rock outcrop. Included areas make up about 10 percent of the unit.

This Brickel soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from granitic rock. The residuum and colluvium have an admixture of volcanic ash and loess. Typically, the surface layer is grayish brown stony loam about 13 inches thick. The subsoil is brown very stony loam about 10 inches thick. The substratum is pale brown very stony sandy loam about 13 inches thick. Fractured granite is at a depth of about 36 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Brickel soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed granitic rock.

This unit is used for rangeland, recreation, watershed, and wildlife habitat.

This unit is suitable as rangeland. The vegetation is mainly common beargrass, sedge, bluebunch wheatgrass, eriogonum, and mountainash. Overgrazing causes the desirable plants, such as common beargrass, bluebunch wheatgrass, and sedge, to decrease in extent and the less desirable plants to increase. A uniform distribution of grazing is unlikely because of the slope. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope, the stones on the surface, and the Rock outcrop. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Brickel soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

27-Buhrig very stony loam, 25 to 40 percent slopes. This moderately deep, well drained soil is on the upper foot slopes and the ridgetops of mountains. It formed in a mantle of volcanic ash and loess and in colluvium and residuum derived dominantly from metasedimentary and igneous rock. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, forbs, shrubs, and grasses. Elevation is 3,000 to 6,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is about 40 degrees F, and the

average growing season (at 28 degrees) is 80 to 100 days.

Typically, the surface is covered with a mat of organic material about 1/2 inch thick. The surface layer is grayish brown very stony loam about 3 inches thick. The upper part of the subsoil is light yellowish brown extremely stony loam about 4 inches thick. The lower part is light yellowish brown extremely stony sandy loam about 4 inches thick. The substratum also is light yellowish brown extremely stony sandy loam. It is about 19 inches thick. Fractured quartzite is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Buhrig very stony loam that has a slope of less than 25 percent or more than 40 percent, Huckleberry silt loam, and Prouty extremely bouldery silt loam. Also included are Manley silt loam and Manley bouldery silt loam on the lower parts of foot slopes, Brickel very stony loam on or near ridgetops, poorly drained soils in draws and adjacent to seeps and springs, and Rock outcrop on ridges and knobs. Included areas make up about 20 percent of the unit.

Permeability is moderate in the surface layer of this Buhrig soil and moderately rapid below the surface layer. Available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, western larch, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent are grand fir and whitebark pine. Based on a 50-year site curve, the mean site index for Douglas fir is 67. The highest average growth rate for Douglas fir is 56 cubic feet per acre per year at age 105. Based on a 50-year site curve, the mean site index for subalpine fir is 95. The estimated highest average growth rate for subalpine fir is 100 cubic feet per acre per year at age 90. Based on a 100-year site curve, the mean site index for lodgepole pine is 77. The highest average growth rate for lodgepole pine is 83 cubic feet per acre per year at age 100. The typical basal area of trees is about 75 percent of that in a normal stand of Douglas fir. Per acre productivity is reduced accordingly. The forest understory is mainly huckleberry, pinegrass, kinnikinnick, pachystima, elk sedge, creambush oceanspray, arnica, Oregongrape, strawberry, rose, common snowberry, and ceanothus.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the stones, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter. The stones on the surface can hinder harvesting. Also, falling timber can break on the stones.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by subalpine fir occurs readily and reforestation by Douglas fir, western larch, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. The very low available water capacity can significantly reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

The capability subclass is VIIs, nonirrigated.

28-Buhrig very stony loam, 40 to 65 percent slopes. This moderately deep, well drained soil is on the back slopes and shoulder slopes of mountains. It formed in a mantle of volcanic ash and loess and in colluvium and residuum derived dominantly from metasedimentary and igneous rock. Slopes are convex or concave and generally have north and east aspects. The native vegetation is mainly conifers, forbs, shrubs, and grasses. Elevation is 3,000 to 6,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 80 to 100 days.

Typically, the surface is covered with a mat of organic material about 1/2 inch thick. The surface layer is grayish brown very stony loam about 3 inches thick. The upper part of the subsoil is light yellowish brown extremely stony loam about 4 inches thick. The lower part is light yellowish brown extremely stony sandy loam about 4 inches thick. The substratum also is light yellowish brown extremely stony sandy loam. It is about 19 inches thick. Fractured quartzite is at a depth of

about 30 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Buhrig very stony loam that has a slope of less than 40 percent or more than 65 percent, Huckleberry silt loam, and Prouty extremely bouldery silt loam. Also included are Manley silt loam and Manley bouldery silt loam on the lower parts of the slopes, Brickel very stony loam on shoulder slopes, poorly drained soils in draws and adjacent to seeps and springs, and Rock outcrop on knobs and ridges. Included areas made up about 20 percent of the unit.

Permeability is moderate in the surface layer of this Buhrig soil and moderately rapid below the surface layer. Available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for woodland, recreation. watershed, and wildlife habitat.

Douglas fir, subalpine fir, western larch, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent are grand fir and whitebark pine. Based on a 50-year site curve, the mean site index for Douglas fir is 67. The highest average growth rate for Douglas fir is 56 cubic feet per acre per year at age 105. Based on a 50-year site curve, the mean site index for subalpine fir is 95. The estimated highest average growth rate for subalpine fir is 100 cubic feet per acre per year at age 90. Based on a 100-year site curve, the mean site index for lodgepole pine is 77. The highest average growth rate for lodgepole pine is 83 cubic feet per acre per year at age 100. The typical basal area of trees is about 75 percent of that in a normal stand of Douglas fir. Per acre productivity is reduced accordingly. The forest understory is mainly huckleberry, pinegrass, kinnikinnick, pachystima, elk sedge, creambush oceanspray, arnica, Oregongrape, strawberry, rose, common snowberry, and ceanothus.

The main limitations affecting timber harvesting are the stones and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter. The stones on the surface can hinder harvesting. Also, falling timber can break on the stones.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by subalpine fir occurs readily and reforestation by Douglas fir, western larch, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. The very low available water capacity can significantly reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

The capability subclass is VIIs, nonirrigated.

29-Buhrig-Rock outcrop complex, 25 to 40 percent slopes. This map unit is on the upper foot slopes and the ridgetops of mountains. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, forbs, shrubs, and grasses. Elevation is 3,000 to 6,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 80 to 100 days.

This unit is about 65 percent Buhrig very stony loam, 25 to 40 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Buhrig very stony loam that has a slope of less than 25 percent or more than 40 percent, Huckleberry silt loam, and Prouty extremely bouldery silt loam. Also included are Manley silt loam and Manley bouldery silt loam on the lower parts of foot slopes, Brickel very stony loam on or near ridgetops, very shallow soils near the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

This Buhrig soil is moderately deep and well drained. It formed in a mantle of volcanic ash and loess and in colluvium and residuum derived dominantly from metasedimentary and igneous rock. Typically, the surface is covered with a mat of organic material about 1/2 inch thick. The surface layer is grayish brown very stony loam about 3 inches thick. The upper part of the subsoil is light yellowish brown extremely stony loam about 4 inches thick. The lower part is light yellowish brown extremely stony sandy loam about 4 inches thick. The substratum also is light yellowish brown extremely

stony sandy loam. It is about 19 inches thick. Fractured quartzite is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the surface layer of the Buhrig soil and moderately rapid below the surface layer. Available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

The Rock outcrop consists mainly of exposed granitic rock, quartzite, and shale.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, western larch, and lodgepole pine are the main woodland species on the Buhrig soil. Among the trees of limited extent are grand fir and whitebark pine. Based on a 50-year site curve, the mean site index for Douglas fir is 67. The highest average growth rate for Douglas fir is 56 cubic feet per acre per year at age 105. Based on a 50-year site curve, the mean site index for subalpine fir is 95. The estimated highest average growth rate for subalpine fir is 100 cubic feet per acre per year at age 90. Based on a 100-year site curve, the mean site index for lodgepole pine is 77. The highest average growth rate for lodgepole pine is 83 cubic feet per acre per year at age 100. The typical basal area of trees on the Buhrig soil is about 75 percent of that in a normal stand of Douglas fir, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly. The forest understory is mainly huckleberry, pinegrass, kinnikinnick, pachystima, elk sedge; creambush oceanspray, arnica, Oregongrape, strawberry, rose, common snowberry, and ceanothus.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the Rock outcrop, the stones, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter. The Rock outcrop and the stones on the surface can hinder harvesting. Also, falling timber can break on the Rock outcrop and the stones.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by subalpine fir occurs readily and reforestation by Douglas fir, western larch, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas for or western larch seedlings. The very low available water capacity can significantly reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

The Buhrig soil is in capability subclass VIIs, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

30-Buhrig-Rock outcrop complex, 40 to 65 percent slopes. This map unit is on the back slopes and shoulder slopes of mountains. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, forbs, shrubs, and grasses. Elevation is 3,000 to 6,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 80 to 100 days.

This unit is about 65 percent Buhrig very stony loam, 40 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Buhrig very stony loam that has a slope of less than 40 percent or more than 65 percent, Huckleberry silt loam, and Prouty extremely bouldery silt loam. Also included are Manley silt loam and Manley bouldery silt loam on the lower parts of the slopes, Brickel very stony loam on shoulder slopes, very shallow soils near the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

This Buhrig soil is moderately deep and well drained. It formed in a mantle of volcanic ash and loess and in colluvium and residuum derived dominantly from metasedimentary and igneous rock. Typically, the surface is covered with a mat of organic material about 1/2 inch thick. The surface layer is grayish brown very stony loam about 3 inches thick. The upper part of the

subsoil is light yellowish brown extremely stony loam about 4 inches thick. The lower part is light yellowish brown extremely stony sandy loam about 4 inches thick. The substratum also is light yellowish brown extremely stony sandy loam. It is about 19 inches thick. Fractured quartzite is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Buhrig soil. Available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed granitic rock and quartzite.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, western larch, and lodgepole pine are the main woodland species on the Buhrig soil. Among the trees of limited extent are grand fir and whitebark pine. Based on a 50-year site curve, the mean site index for Douglas fir is 67. The highest average growth rate for Douglas fir is 56 cubic feet per acre per year at age 105. Based on a 50-year site curve, the mean site index for subalpine fir is 95. The estimated highest average growth rate for subalpine fir is 100 cubic feet per acre per year at age 90. Based on a 100-year site curve, the mean site index for lodgepole pine is 77. The highest average growth rate for lodgepole pine is 83 cubic feet per acre per year at age 100. The typical basal area of trees on the Buhrig soil is about 75 percent of that in a normal stand of Douglas fir, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly. The forest understory is mainly huckleberry, pinegrass, kinnikinnick, pachystima, elk sedge, creambush oceanspray, arnica, Oregongrape, strawberry, rose, common snowberry, and ceanothus.

The main limitations affecting timber harvesting are the Rock outcrop, the stones, and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter. The Rock outcrop and the stones on the surface can hinder harvesting. Also, falling timber can break on the Rock outcrop and the stones.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by subalpine fir occurs readily and reforestation by Douglas fir, western larch, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. The very low available water capacity can significantly reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

The Buhrig soil is in capability subclass VIIs, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

31-Clayton fine sandy loam, 0 to 5 percent slopes. This very deep, well drained soil is on terraces. It formed in glaciofluvial material of mixed mineralogy. This material has an admixture of volcanic ash and loess in the upper part. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 2,200 feet. The average annual precipitation is 22 to 27 inches, the average annual air temperature is about 46 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1/2 inch thick. When mixed to a depth of about 7 inches, the surface layer is brown fine sandy loam. The subsoil is light yellowish brown fine sandy loam about 10 inches thick. The next 11 inches also is light yellowish brown fine sandy loam. Below this is about 19 inches of very pale brown loamy fine sand that has bands of dark brown loam 1/16 to 1/4 inch thick. The substratum to a depth of 60 inches or more is light yellowish brown loamy fine sand.

Included in this unit are small areas of Clayton fine sandy loam that has a slope of more than 5 percent, Bonner silt loam, and Eloika silt loam. Included areas make up about 15 percent of the unit.

Permeability is moderate to a depth of 28 inches in this Clayton soil and moderately rapid below that depth. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for nonirrigated and irrigated crops,

grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

This unit is suited to nonirrigated and irrigated oats, barley, and grass-legume hay. The main management concern is the hazard of water erosion. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Stripcropping and diversions or terraces may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

Douglas fir, ponderosa pine, western larch, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent is grand fir. Based on a 50-year site curve, the mean site index for Douglas fir is 77. The highest average growth rate for Douglas fir is 75 cubic feet per acre per year at age 99. Based on a 100-year site curve, the mean site index for ponderosa pine is 115. The highest average growth rate for ponderosa pine is 132 cubic feet per acre per year at age 40. The typical basal area of trees is about 75 percent of that in normal stands of Douglas fir and ponderosa pine. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, western larch, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, common snowberry, Oregongrape, huckleberry, pachystima, strawberry, kinnikinnick, Saskatoon serviceberry, rose, white spirea, creambush oceanspray, and mallow ninebark. Overgrazing causes the desirable plants, such as pinegrass, Saskatoon serviceberry, creambush oceanspray, mallow ninebark, and rose, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

The main limitation on homesites is the instability of cutbanks. The sides of shallow excavations can cave in unless they are supported by special retainer walls.

Septic tank absorption fields can function well if they are properly installed. Seepage from the absorption fields can contaminate ground water because the substratum is moderately rapidly permeable.

The capability subclass is IIIe, irrigated and nonirrigated.

32-Clayton fine sandy loam, 5 to 15 percent slopes. This very deep, well drained soil is on terraces. It formed in glaciofluvial material of mixed mineralogy. This material has an admixture of volcanic ash and loess in the upper part. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 2,200 feet. The average annual precipitation is 22 to 27 inches, the average annual air temperatures is about 46 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1/2 inch thick. When mixed to a depth of about 7 inches, the surface layer is brown fine sandy loam. The subsoil is light yellowish brown fine sandy loam about 10 inches thick. The next 11 inches also is light yellowish brown fine sandy loam. Below this is about 19 inches of very pale brown loamy fine sand that has bands of dark brown loam 1/16 to 1/4 inch thick. The substratum to a depth of 60 inches or more is light yellowish brown loamy fine sand.

Included in this unit are small areas of Clayton fine sandy loam that has a slope of less than 5 percent or more than 15 percent, Bonner silt loam, and Eloika silt loam. Included areas make up about 15 percent of the unit.

Permeability is moderate to a depth of 28 inches in this Clayton soil and moderately rapid below that depth. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium,

and the hazard of water erosion is moderate.

This unit is used for nonirrigated and irrigated crops, grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

This unit is suited to nonirrigated and irrigated oats, barley, and grass-legume hay. The main management concerns are the hazard of water erosion and the slope. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

Douglas fir, ponderosa pine, western larch, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent is grand fir. Based on a 50-year site curve, the mean site index for Douglas fir is 77. The highest average growth rate for Douglas fir is 75 cubic feet per acre per year at age 99. Based on a 100-year site curve, the mean site index for ponderosa pine is 115. The highest average growth rate for ponderosa pine is 132 cubic feet per acre per year at age 40. The typical basal area of trees is about 75 percent of that in normal stands of Douglas fir and ponderosa pine. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, western larch, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, common snowberry, Oregongrape, huckleberry, pachystima, strawberry, kinnikinnick, Saskatoon serviceberry, rose, white spirea, creambush oceanspray, and mallow ninebark. Overgrazing causes the desirable plants, such as pinegrass, Saskatoon serviceberry, creambush oceanspray, mallow ninebark, and rose, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

The main limitations on homesites are the slope and the instability of cutbanks. Special designs for buildings may be needed to overcome the slope. The sides of shallow excavations can cave in unless they are supported by special retainer walls.

The main limitation on sites for septic tank absorption fields is the slope. The absorption lines should be installed on the contour. Seepage from the absorption fields can contaminate ground water because the substratum is moderately rapidly permeable.

The capability subclasses are IVe, irrigated, and IIIe, nonirrigated.

33-Conto silt loam, 0 to 30 percent slopes. This very deep, well drained soil is on the toe slopes and foot slopes of mountains. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are concave and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 4,000 to 5,800 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is about 38 degrees F, and the average growing season (at 28 degrees) is 60 to 90 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 7 inches, the surface layer is light yellowish brown silt loam. The subsoil is brownish yellow silt loam about 5 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown, olive, and pale olive very gravelly sandy loam.

Included in this unit are small areas of Conto silt loam that has a slope of more than 30 percent, Buhrig very stony loam, Conto Variant sandy loam, Huckleberry silt loam, and Manley silt loam. Also included are Brickel stony loam on the upper parts of the slopes and Rock outcrop on ridges and knobs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Conto soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Subalpine fir, Engelmann spruce, and Douglas fir are the main woodland species on this unit. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for subalpine fir is 82. The highest average growth rate for subalpine fir is 79 cubic feet per acre per year at age 100. Based on a 50-year site curve, the mean site index for western white pine is 42. The highest average growth rate for western white pine is 87 cubic feet per acre per year at age 105. Estimates of the site index and growth rate for Engelmann spruce and Douglas fir have not been made. The forest understory is mainly pachystima, common snowberry, ceanothus, common beargrass, common princes pine, Saskatoon serviceberry, strawberry, fescue, and huckleberry.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

The capability subclass is VIe, nonirrigated.

34-Conto silt loam, 30 to 65 percent slopes. This *very* deep, well drained soil is on the back slopes of mountains. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are concave and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 4,000 to 5,800 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is about 38 degrees F, and the average growing season (at 28 degrees) is 60 to 90 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 7 inches, the surface layer is light yellowish brown silt loam. The subsoil is brownish yellow silt loam about 5 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown, olive, and pale olive very gravelly sandy loam.

Included in this unit are small areas of Conto silt loam that has a slope of less than 30 percent or more than 65 percent, Buhrig very stony loam, Conto Variant sandy loam, Huckleberry silt loam, and Manley silt loam. Also included are Brickel stony loam on the upper parts of the slopes and ridgetops and Rock outcrop on ridges and knobs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Conto soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Subalpine fir, Engelmann spruce, and Douglas fir are the main woodland species on this unit. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for subalpine fir is 82. The highest average growth rate for subalpine fir is 79 cubic feet per acre per year at age 100. Based on a 50-year site curve, the mean site index for western white pine is 42. The highest average growth rate for western white pine is 87 cubic feet per acre per year at age 105. Estimates of the site index and growth rate for Engelmann spruce and Douglas fir have not been made. The forest understory is mainly pachystima, common snowberry, ceanothus, common beargrass, common princes pine, Saskatoon serviceberry, strawberry, fescue, and huckleberry.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant

cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

The capability subclass is VIIe, nonirrigated.

35-Conto Variant sandy loam, 0 to 30 percent slopes. This very deep, well drained soil is on the toe slopes and foot slopes of mountains. It formed in a mantle of volcanic ash and loess over calcareous glacial till. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,900 to 5,200 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is about 38 degrees F, and the average growing season (at 28 degrees) is 60 to 90 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 6 inches, the surface layer is yellowish red sandy loam. The upper part of the subsoil is strong brown sandy loam about 3 inches thick. The next part is dark yellowish brown gravelly loam about 6 inches thick. The lower part is light olive brown very gravelly very fine sandy loam about 20 inches thick. The upper part of the substratum is pale yellow very gravelly silt loam about 5 inches thick. The lower part to a depth of 60 inches or more is pale yellow very gravelly loamy sand.

Included in this unit are small areas of Conto Variant sandy loam that has a slope of more than 30 percent, Huckleberry silt loam, and Prouty Variant silt loam. Also included are Conto silt loam on the lower parts of the slopes and Rock outcrop on ridges and knobs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Conto Variant soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on this unit. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 74. The highest average growth rate for Douglas fir is 69 cubic feet per acre per year at age 101. Based on a 50-year site curve, the mean site index for western larch is 60. The highest average growth rate for western larch is 81 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for lodgepole pine is 94. The highest average growth rate for lodgepole pine is 115 cubic feet per acre per year at age 100. The typical basal area of trees is about 60 percent of that in normal stands of Douglas fir, subalpine fir, and lodgepole pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for subalpine fir and Engelmann spruce have not been made. The forest understory is mainly pachystima, ceanothus, strawberry, willow, common beargrass, common princes pine, common snowberry, Saskatoon serviceberry, fescue, huckleberry, longtube twinflower, alder, and honeysuckle.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

The capability subclass is VIe, nonirrigated.

36-Conto Variant sandy loam, 30 to 65 percent slopes. This very deep, well drained soil is on the back slopes of mountains. It formed in a mantle of volcanic ash and loess over calcareous glacial till. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,900 to 5,200 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is about 38 degrees F, and the average growing season (at 28 degrees) is 60 to 90 days.

Typically, the surface is covered with a mat of

organic material about 1 inch thick. When mixed to a depth of about 6 inches, the surface layer is yellowish red sandy loam. The upper part of the subsoil is strong brown sandy loam about 3 inches thick. The next part is dark yellowish brown gravelly loam about 6 inches thick. The lower part is light olive brown very gravelly very fine sandy loam about 20 inches thick. The upper part of the substratum is pale yellow very gravelly silt loam about 5 inches thick. The lower part to a depth of 60 inches or more is pale yellow very gravelly loamy sand.

Included in this unit are small areas of Conto Variant silt loam that has a slope of less than 30 percent, Huckleberry silt loam, and Prouty Variant silt loam. Also included are Conto silt loam on the lower parts of the slopes and Rock outcrop on ridges and knobs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Conto Variant soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on this unit. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 74. The highest average growth rate for Douglas fir is 69 cubic feet per acre per year at age 101. Based on a 50-year site curve, the mean site index for western larch is 60. The highest average growth rate for western larch is 81 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for lodgepole pine is 94. The highest average growth rate for lodgepole pine is 115 cubic feet per acre per year at age 100. The typical basal area of trees is about 60 percent of that in normal stands of Douglas fir, subalpine fir, and lodgepole pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for subalpine fir and Engelmann spruce have not been made. The forest understory is mainly pachystima, ceanothus, strawberry, willow, common beargrass, common princes pine, common snowberry, Saskatoon serviceberry, fescue, huckleberry, longtube twinflower, alder, and honeysuckle.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled and in other recently disturbed areas reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

The capability subclass is VIIe, nonirrigated.

37-Cryands, 0 to 40 percent slopes. These moderately deep to very deep, well drained soils are on mountains. They formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are concave and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,500 to 5,000 feet. The average annual precipitation is 35 to 45 inches, the average annual air temperature is about 39 degrees F, and the average growing season (at 28 degrees) is 70 to 90 days.

No single profile is typical of these soils. In one commonly observed in the survey area, however, the surface is covered with a mat of organic material about 6 inches thick. When mixed to a depth of about 10 inches, the surface layer is brown silt loam. The subsoil also is brown silt loam. It is about 13 inches thick. The substratum is light yellowish brown very gravelly loam about 27 inches thick. Conglomerate is at a depth of about 50 inches. The depth to bedrock ranges from 30 to more than 60 inches. The texture, color, and thickness of the layers in these soils vary widely from one area to another and occasionally within short distances. The surface layer is very dark grayish brown to yellowish brown. It is silt loam, loam, gravelly silt loam, or gravelly loam. The substratum is mainly gravelly to extremely gravelly loam or very gravelly or extremely gravelly sandy loam.

Included in this unit are small areas of Cryands that have a slope of more than 40 percent, Buhrig very stony loam, and Huckleberry silt loam. Also included are Brickel stony loam on the upper parts of the slopes and Manley silt loam on the concave lower back slopes.

Included areas make up about 20 percent of the unit.

Permeability is moderate in the Cryands. Available water capacity is moderate or high. The effective rooting depth is 30 to more than 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on this unit. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for subalpine fir is 72. The highest average growth rate for subalpine fir is 66 cubic feet per acre per year at age 110. The typical basal area of trees is about 55 percent of that in a normal stand of subalpine fir. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for Douglas fir and Engelmann spruce have not been made. The forest understory is mainly pachystima, sedge, common princes pine, common beargrass, huckleberry, common snowberry, thimbleberry, queencup beadlily, longtube twinflower, and alder.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soils are moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soils are dry. Puddling can occur when the soils are wet. Low-pressure ground equipment damages the soils less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled and in other recently disturbed areas reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

The capability subclass is VIe, nonirrigated.

38-Cusick silty clay loam. This very deep, somewhat poorly drained soil is in basins. It formed in fine textured glacial lake sediments. Slope is 0 to 3 percent. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 2,200 feet. The average annual precipitation is 25 to 27 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 100 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface layer is gray silty clay loam about 7 inches thick. The subsoil is light gray, mottled silty clay about 30 inches thick. The upper 21 inches of the substratum is white, mottled silty clay. The lower part to a depth of 60 inches or more is white, mottled very fine sandy loam.

Included in this unit are small areas of Blueslide silt loam, Dalkena fine sandy loam, Pywell muck, and Sacheen Variant silt loam. Included areas make up about 20 percent of the unit.

Permeability is very slow in the Cusick soil. Available water capacity is high. The effective rooting depth is limited by a perched seasonal high water table within a depth of 2 feet from November through April. Runoff is very slow, and the hazard of water erosion is slight.

This unit is used for nonirrigated and irrigated crops, grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

This unit is suited to nonirrigated and irrigated oats and grass-legume hay. The main limitation is the seasonal wetness. Tile drains and open ditches have been used in most areas to remove excess surface and subsurface water where suitable outlets are available. Minimum tillage helps to prevent compaction. A tillage pan forms if the soil is tilled when wet. In some years spring planting is delayed because of wetness. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture and maintain good tilth. A common crop rotation is 8 to 10 years of grass, such as timothy, and legume hay, such as red clover, and 2 years of grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients. Because of the very slow permeability of this soil, water applications should be regulated so that the water does not stand on the surface and damage the crops.

Ponderosa pine is the main woodland species on this unit. Among the trees of limited extent are Douglas fir, western white pine, and lodgepole pine. Based on a 100-year site curve, the mean site index for ponderosa

pine is 110. The highest average growth rate for ponderosa pine is 122 cubic feet per acre per year at age 40. The typical basal area of trees is about 90 percent of that in a normal stand of ponderosa pine. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are sticky and slippery and can be impassable. If roads are constructed on this unit, additional rock is needed to improve the ability of the soil to support equipment. A perched seasonal high water table restricts the use of equipment to periods when the soil is dry in the upper part or when it is protected by snowpack. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. The perched seasonal high water table, which hinders root respiration, may result in a low seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and prevent the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the perched seasonal high water table, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly Oregongrape, Saskatoon serviceberry, common snowberry, pinegrass, spirea, longtube twinflower, hawthorn, rose, fescue, ceanothus, and sedge. Overgrazing causes the desirable plants, such as pinegrass, fescue, rose, and Saskatoon serviceberry, to decrease in extent and the less desirable plants to increase. Wetness can limit access by livestock. Compaction can occur in areas that are grazed or browsed when the soil is wet. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the seasonal wetness. Seeding with ground equipment, such as a range drill, and broadcasting are the most effective seeding methods.

The main limitation on homesites is the seasonal wetness. Tile drains and open ditches can lower the water table if suitable outlets are available.

Septic tank absorption fields cannot function properly because of the very slow permeability and the seasonal wetness. As a result, the effluent can contaminate ground water.

The capability subclass is IIIw, irrigated and nonirrigated.

39-Dalkena fine sandy loam, 0 to 7 percent slopes. This very deep, moderately well drained soil is on terraces. It formed in glaci-fluvial deposits over clayey glacial lake sediments. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface layer is light brownish gray fine sandy loam about 8 inches thick. The upper 6 inches of the subsoil is light gray fine sandy loam. The lower 10 inches is light gray, mottled fine sandy loam. The upper 6 inches of the substratum is light gray sandy loam. The lower part to a depth of 60 inches or more is light gray and light brownish gray, mottled silty clay loam.

Included in this unit are small areas of Dalkena fine sandy loam that has a slope of more than 7 percent, Cusick silty clay loam, Martella silt loam, Rathdrum very fine sandy loam, Sacheen loamy fine sand, and Scotia fine sandy loam. Also included are poorly drained soils in depressions. Included areas make up about 20 percent of the unit.

Permeability is moderate to a depth of 30 inches in this Dalkena soil and slow below that depth. Available water capacity is high. The effective rooting depth is limited by a perched seasonal high water table at a depth of 2 to 3 feet from February through April. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for grazable woodland, nonirrigated and irrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, ponderosa pine, and western larch are the main woodland species on this unit. Among the trees of limited extent are grand fir and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 82. The highest average growth rate for Douglas fir is 86 cubic feet per acre per year at age 96. Based on a 100-year site curve, the mean site index for ponderosa pine is 107. The highest average growth rate for ponderosa pine is 116 cubic feet per acre per year at age 40. Estimates of the site index and growth rate for western larch have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily

when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. In winter occasional snowpack hinders the use of equipment.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, and western larch occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the perched seasonal high water table, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly common snowberry, pinegrass, Oregongrape, prairie junegrass, Idaho fescue, ceanothus, spirea, mallow ninebark, rose, strawberry, and hawthorn. Overgrazing causes the desirable plants, such as pinegrass, prairie junegrass, Idaho fescue, rose, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Wetness can limit access by livestock. Compaction can occur in areas that are grazed or browsed when the soil is wet. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the seasonal wetness. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated and irrigated wheat, barley, oats, and grass-legume hay. The main management concerns are the seasonal wetness and the hazard of water erosion. Minimum tillage helps to prevent compaction. A tillage pan forms if the soil is tilled when wet. In some years spring planting is delayed because of wetness. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good filth, and control erosion. Stripcropping and diversions or terraces may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

The main limitation on homesites is the seasonal wetness. A drainage system is needed on sites for buildings with basements and crawl spaces because of the perched seasonal high water table.

The main !imitations on sites for septic tank absorption fields are the slow permeability in the substratum and the seasonal wetness. Installing interceptor drains, adding topsoil, and installing longer absorption lines on the contour help to compensate for these limitations.

The capability subclass is IIIe, irrigated and nonirrigated.

40-Dalkena fine sandy loam, 7 to 15 percent slopes. This very deep, moderately well drained soil is on terraces. It formed in glaciofluvial deposits over clayey glacial lake sediments. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface layer is light brownish gray fine sandy loam about 8 inches thick. The upper 6 inches of the subsoil is light gray fine sandy loam. The lower 10 inches is light gray, mottled fine sandy loam. The upper 6 inches of the substratum is light gray sandy loam. The lower part to a depth of 60 inches or more is light gray and light brownish gray, mottled silty clay loam.

Included in this unit are small areas of Dalkena fine sandy loam that has a slope of less than 7 percent or more than 15 percent, Anglen silt loam, Cusick silty clay loam, Kaniksu sandy loam, Martella silt loam, Sacheen loamy fine sand, and Scotia fine sandy loam. Also included are poorly drained soils in depressions. Included areas make up about 20 percent of the unit.

Permeability is moderate to a depth of 30 inches in this Dalkena soil and slow below that depth. Available water capacity is high. The effective rooting depth is limited by a perched seasonal high water table at a depth of 2 to 3 feet from February through April. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated and irrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, ponderosa pine, and western larch are the main woodland species on this unit. Among the trees of limited extent are grand fir and western white pine. Based on a 50-year site curve, the mean site

index for Douglas fir is 82. The highest average growth rate for Douglas fir is 86 cubic feet per acre per year at age 96. Based on a 100-year site curve, the mean site index for ponderosa pine is 107. The highest average growth rate for ponderosa pine is 116 cubic feet per acre per year at age 40. Estimates of the site index and growth rate for western larch have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, and western larch occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the perched seasonal high water table, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly common snowberry, pinegrass, Oregongrape, prairie junegrass, Idaho fescue, ceanothus, spirea, mallow ninebark, rose, strawberry, and hawthorn. Overgrazing causes the desirable plants, such as pinegrass, prairie junegrass, Idaho fescue, rose, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Wetness can limit access by livestock. Compaction can occur in areas that are grazed or browsed when the soil is wet. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the seasonal wetness. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated and irrigated wheat, barley, oats, and grass-legume hay. The main management concerns are the seasonal wetness, the hazard of water erosion, and the slope. Minimum tillage helps to prevent compaction. A tillage pan forms if the soil is tilled when wet. In some years spring planting is delayed because of wetness. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

The main limitations on homesites are the slope and the seasonal wetness. Special designs for buildings may be needed to overcome the slope. A drainage system is needed on sites for buildings with basements and crawl spaces because of the perched seasonal high water table.

The main limitations on sites for septic tank absorption fields are the slope, the slow permeability in the substratum, and the seasonal wetness. Where the slope is a concern, the absorption lines should be installed on the contour. Installing interceptor drains, adding topsoil, and installing longer absorption lines on the contour help to compensate for the limitations of this soil.

The capability subclasses are IVe, irrigated, and IIIe, nonirrigated.

41-Dalkena fine sandy loam, 15 to 25 percent slopes. This very deep, moderately well drained soil is on terraces. It formed in glaciofluvial deposits over clayey glacial lake sediments. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface layer is light brownish gray fine sandy loam about 8 inches thick. The upper 6 inches of the subsoil is light gray fine sandy loam. The lower 10 inches is light gray, mottled fine sandy loam. The upper 6 inches of the substratum is light gray sandy loam. The lower part to a depth of 60 inches or more is light gray and light brownish gray, mottled silty clay loam.

Included in this unit are small areas of Dalkena fine sandy loam that has a slope of less than 15 percent or more than 25 percent, Kaniksu sandy loam, Martella silt loam, Sacheen loamy fine sand, and Scotia fine sandy

loam. Also included are poorly drained soils in depressions. Included areas make up about 20 percent of the unit.

Permeability is moderate to a depth of 30 inches in this Dalkena soil and slow below that depth. Available water capacity is high. The effective rooting depth is limited by a perched seasonal high water table at a depth of 2 to 3 feet from February through April. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated and irrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, ponderosa pine, and western larch are the main woodland species on this unit. Among the trees of limited extent are grand fir and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 82. The highest average growth rate for Douglas fir is 86 cubic feet per acre per year at age 96. Based on a 100-year site curve, the mean site index for ponderosa pine is 107. The highest average growth rate for ponderosa pine is 116 cubic feet per acre per year at age 40. Estimates of the site index and growth rate for western larch have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, and western larch occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the perched seasonal high water table, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly common snowberry, pinegrass, Oregongrape, prairie junegrass, Idaho fescue, ceanothus, spirea, mallow ninebark, rose, strawberry, and hawthorn. Overgrazing causes the desirable plants, such as pinegrass, prairie junegrass, Idaho fescue, rose, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Wetness can limit access by livestock. Compaction can occur in areas that are grazed or browsed when the soil is wet. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the seasonal wetness. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated and irrigated wheat, barley, oats, and grass-legume hay. The main limitations are the seasonal wetness and the slope. Minimum tillage helps to prevent compaction. A tillage pan forms if the soil is tilled when wet. In some years spring planting is delayed because of wetness. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming and stripcropping may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

The main limitations on homesites are the slope and the seasonal wetness. Special designs for buildings may be needed to overcome the slope. Because of the perched seasonal high water table, a drainage system is needed on sites for buildings with basements and crawl spaces.

Septic tank absorption fields cannot function properly because of the slope, the slow permeability in the substratum, and the seasonal wetness. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is IVe, irrigated and nonirrigated.

42-Dalkena fine sandy loam, 25 to 40 percent slopes. This very deep, moderately well drained soil is on terrace escarpments. It formed in glaciofluvial deposits over clayey glacial lake sediments. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110

days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface layer is light brownish gray fine sandy loam about 8 inches thick. The upper 6 inches of the subsoil is light gray fine sandy loam. The lower 10 inches is light gray, mottled fine sandy loam. The upper 6 inches of the substratum is light gray sandy loam. The lower part to a depth of 60 inches or more is light gray and light brownish gray, mottled silty clay loam.

Included in this unit are small areas of Dalkena fine sandy loam that has a slope of less than 25 percent or more than 40 percent, Kaniksu sandy loam, Martella silt loam, Sacheen loamy fine sand, and Scotia fine sandy loam. Also included are poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

Permeability is moderate to a depth of 30 inches in this Dalkena soil and slow below that depth. Available water capacity is high. The effective rooting depth is limited by a perched seasonal high water table at a depth of 2 to 3 feet from February through April. Runoff is rapid, and the hazard of water erosion is severe. This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat. Douglas fir, ponderosa pine, and western larch are the main woodland species on this unit. Among the trees of limited extent are grand fir and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 82. The highest average growth rate for Douglas fir is 86 cubic feet per acre per year at age 96. Based on a 100-year site curve, the mean site index for ponderosa pine is 107. The highest average growth rate for ponderosa pine is 116 cubic feet per acre per year at age 40. Estimates of the site index and growth rate for western larch have not been made.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled or tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, and western larch occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the perched seasonal high water table, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly common snowberry, pinegrass, Oregongrape, prairie junegrass, Idaho fescue, ceanothus, spirea, mallow ninebark, rose, strawberry, and hawthorn. Overgrazing causes the desirable plants, such as pinegrass, prairie junegrass, Idaho fescue, rose, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Wetness can limit access to livestock. Compaction can occur in areas that are grazed or browsed when the soil is wet, Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the seasonal wetness and the slope. Broadcasting is the most effective seeding method.

The main limitations on homesites are the slope and the seasonal wetness. Special designs for buildings may be needed to overcome the slope. Because of the perched seasonal high water table, a drainage system is needed on sites for buildings with basements and crawl spaces.

Septic tank absorption fields cannot function properly because of the slope, the slow permeability in the substratum, and the seasonal wetness. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is VIe, nonirrigated.

43-Dufort silt loam, 0 to 15 percent slopes. This very deep, well drained soil is on foothills. It formed in a thick mantle of volcanic ash and loess over glacial drift of mixed mineralogy. Slopes are convex. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 5 inches, the surface layer is light yellowish brown silt loam. The upper part of the subsoil also is light yellowish brown silt loam. It is about 13

inches thick. The lower part is pale brown gravelly loam about 12 inches thick. The substratum to a depth of 60 inches or more is pale brown very gravelly sandy loam.

Included in this unit are small areas of Dufort silt loam that has a slope of more than 15 percent, Dufort very stony silt loam, Aits loam, Bonner silt loam, Martella silt loam, Newbell silt loam, and Scrabblers silt loam. Included areas make up about 20 percent of the unit.

Permeability is moderate to a depth of 30 inches in this Dufort soil and moderately rapid below that depth. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, ponderosa pine, western larch, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent are grand fir and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 78. The highest average growth rate for Douglas fir is 77 cubic feet per acre per year at age 98. Based on a 100-year site curve, the mean site index for ponderosa pine is 98. The highest average growth rate for ponderosa pine is 99 cubic feet per acre per year at age 40. The typical basal area of trees is about 85 percent of that in normal stands of Douglas fir and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western larch and lodgepole pine have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, western larch, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, pachystima, common snowberry, mallow ninebark, blueberry, Idaho fescue, longtube twinflower, creambush oceanspray, elk sedge, and kinnikinnick. Overgrazing causes the desirable plants, such as pinegrass, elk sedge, and Idaho fescue, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated barley, wheat, oats, and grass-legume hay. The main management concerns are the hazard of water erosion and the slope. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions or terraces may be needed to control erosion on cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

The main limitation on homesites is the slope. Special designs for buildings may be needed to overcome the slope.

The main limitation on sites for septic tank absorption fields is the slope. The absorption lines should be installed on the contour. Seepage can contaminate ground water because the substratum is moderately rapidly permeable.

The capability subclass is IIIe, nonirrigated.

44-Dufort very stony silt loam, 0 to 40 percent slopes. This very deep, well drained soil is on the toe slopes and foot slopes of foothills. It formed in a mantle of volcanic ash and loess over glacial drift of mixed mineralogy. Slopes are convex. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is light yellowish brown very stony silt loam about 12 inches thick. The subsoil is pale brown gravelly loam about 14 inches thick. The substratum to a depth of 60 inches or more is pale brown very gravelly sandy loam.

Included in this unit are small areas of Dufort very stony silt loam that has a slope of more than 40 percent, Dufort silt loam, Aits stony loam. Bonner gravelly silt loam, Martella silt loam, Newbell stony silt

loam, and Scrabblers silt loam. Included areas make up about 20 percent of the unit.

Permeability is moderate to a depth of 26 inches in this Dufort soil and moderately rapid below that depth. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, ponderosa pine, western larch, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent are grand fir and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 78. The highest average growth rate for Douglas fir is 77 cubic feet per acre per year at age 98. Based on a 100-year site curve, the mean site index for ponderosa pine is 98. The highest average growth rate for ponderosa pine is 99 cubic feet per acre per year at age 40. The typical basal area of trees is about 85 percent of that in normal stands of Douglas fir and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western larch and lodgepole pine have not been made.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the stones, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The stones on the surface can hinder harvesting. Also, falling timber can break on the stones.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, western larch, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, common snowberry, pachystima, blueberry, bluebunch wheatgrass, Idaho fescue, elk sedge, creambush oceanspray, kinnikinnick, ceanothus, Oregongrape, and mallow ninebark. Overgrazing causes the desirable plants, such as pinegrass, elk sedge, and Idaho fescue, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the stones on the surface and the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The main limitation on homesites is the slope. Special designs for buildings may be needed to overcome the slope.

The main limitation on sites for septic tank absorption fields is the slope. Where the slope is less than 15 percent, the absorption fields can function properly if the absorption lines are installed on the contour as needed. The absorption fields cannot function properly on the steeper slopes. As a result, the effluent can surface in downslope areas and create a health hazard. Because the substratum is moderately rapidly permeable, seepage from the absorption fields can contaminate ground water.

The capability subclass is VIs, nonirrigated.

45-Eloika silt loam, 0 to 15 percent slopes. This very deep, well drained soil is on terraces. It formed in a mantle of volcanic ash and loess over glacial drift of mixed mineralogy. Slopes are complex. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 22 to 28 inches, the average annual air temperature is about 46 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 5 inches, the surface layer is yellowish brown silt loam. The upper part of the subsoil also is yellowish brown silt loam. It is about 9 inches thick. The lower part is pale brown loam about 6 inches thick. The upper part of the substratum is pale brown gravelly loam about 20 inches thick. The next part is pale brown very gravelly sandy loam about 10 inches thick. The lower part to a depth of 60 inches or more is multicolored extremely gravelly coarse sand.

Included in this unit are small areas of Eloika silt loam that has a slope of more than 15 percent, Aits loam, Bonner silt loam, Clayton fine sandy loam, Martella silt loam, and Newbell silt loam, Included areas

make up about 20 percent of the unit.

Permeability is moderate to a depth of 20 inches in this Eloika soil and moderately rapid below that depth. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, ponderosa pine, western larch, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent is grand fir. Based on a 50-year site curve, the mean site index for Douglas fir is 79. The highest average growth rate for Douglas fir is 79 cubic feet per acre per year at age 98. Based on a 50-year site curve, the estimated mean site index for western larch is 65. The estimated highest average growth rate for western larch is 91 cubic feet per acre per year at age 70. The typical basal area of trees is about 70 percent of that in normal stands of Douglas fir and western larch. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for ponderosa pine and lodgepole pine have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, western larch, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, spirea, huckleberry, Oregongrape, ceanothus, bluebunch wheatgrass, Idaho fescue, strawberry, common snowberry, kinnikinnick, mallow ninebark, and creambush oceanspray. Overgrazing causes the desirable plants, such as pinegrass, Idaho fescue, and bluebunch wheatgrass, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated barley, wheat, oats, and grass-legume hay. The main management concerns are the hazard of water erosion and the slope. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good filth, and control erosion. Stripcropping and diversions or terraces may be needed to control erosion on cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

The main limitations on homesites are the slope and the instability of cutbanks. Special designs for buildings may be needed to overcome the slope. The sides of shallow excavations can cave in unless they are supported by special retainer walls.

The main limitation on sites for septic tank absorption fields is the slope. The absorption lines should be installed on the contour. Seepage can contaminate ground water because the lower part of the substratum is very rapidly permeable.

The capability subclass is IIIe, nonirrigated.

46-Hartill silt loam, 0 to 15 percent slopes. This moderately deep, well drained soil is on the toe slopes and ridgetops of foothills and mountains. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from phyllite and quartzite. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. When mixed to a depth of about 8 inches, the surface layer is pale brown silt loam. The upper part of the subsoil also is pale brown silt loam. It is about 4 inches thick. The lower part is light yellowish brown channery loam about 6 inches thick. The upper part of the substratum is light yellowish brown very channery loam about 9 inches thick. The lower part is very pale brown very channery loam about 9 inches thick. Phyllite is at a depth of about 36 inches. The depth to bedrock ranges from 20 to 40

inches. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Included in this unit are small areas of Hartill silt loam that has a slope of more than 15 percent, Aits loam, and Newbell silt loam. Also included are Raisio channery loam on south- and west-facing slopes and Rock outcrop on ridges and knobs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Hartill soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, ponderosa pine, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 82. The highest average growth rate for Douglas fir is 86 cubic feet per acre per year at age 96. Based on a 50-year site curve, the estimated mean site index for western larch is 55. The estimated highest average growth rate for western larch is 72 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 117. The highest average growth rate for ponderosa pine is 135 cubic feet per acre per year at age 40. The typical basal area of trees is about 75 percent of that in normal stands of Douglas fir and western larch. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, ponderosa pine, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir, western larch, ponderosa pine, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the depth to bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, spirea, creambush oceanspray, Oregongrape, huckleberry, Saskatoon serviceberry, thimbleberry, rose, common snowberry, mallow ninebark, pachystima, and ceanothus. Overgrazing causes the desirable plants, such as pinegrass, mallow ninebark, rose, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated barley and grass-legume hay. The main management concerns are the low available water capacity, the hazard of water erosion, and the slope. The crops that are tolerant of drought grow best. The amount of available moisture is not adequate for most other crops to grow well. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions or terraces may be needed to control erosion on cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

The main limitations on homesites are the slope and the depth to bedrock. Special designs for buildings may be needed to overcome the slope. The cuts needed to provide essentially level building sites can expose the bedrock.

Septic tank absorption fields cannot function properly because of the depth to bedrock. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is IIIe, nonirrigated.

47-Hartill silt loam, 15 to 25 percent slopes. This moderately deep, well drained soil is on the toe slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from phyllite and quartzite. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 27 to

35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. When mixed to a depth of about 8 inches, the surface layer is pale brown silt loam. The upper part of the subsoil also is pale brown silt loam. It is about 4 inches thick. The lower part is light yellowish brown channery loam about 6 inches thick. The upper part of the substratum is light yellowish brown very channery loam about 9 inches thick. The lower part is very pale brown *very* channery loam about 9 inches thick. Phyllite is at a depth of about 36 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Included in this unit are small areas of Hartill silt loam that has a slope of less than 15 percent or more than 25 percent, Aits loam, and Newbell silt loam. Also included are Raisio channery loam on south- and west-facing slopes and Rock outcrop on knobs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Hartill soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, ponderosa pine, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 81. The highest average growth rate for Douglas fir is 83 cubic feet per acre per year at age 96. Based on a 50-year site curve, the mean site index for western larch is 56. The highest average growth rate for western larch is 74 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 117. The highest average growth rate for ponderosa pine is 135 cubic feet per acre per year at age 40. The typical basal area of trees is about 75 percent of that in normal stands of Douglas fir and western larch. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, ponderosa tine, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir, western larch, ponderosa pine, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the depth to bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, spirea, creambush oceanspray, Oregongrape, huckleberry, Saskatoon serviceberry, thimbleberry, rose, common snowberry, mallow ninebark, pachystima, and ceanothus. Overgrazing causes the desirable plants, such as pinegrass, mallow ninebark, rose, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated barley and grass-legume hay. The main management concerns are the hazard of water erosion and the slope. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming and stripcropping may be needed to control erosion on cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 years of small grain.

The main limitations on homesites are the slope and the depth to bedrock. Special designs for buildings may be needed to overcome the slope. The cuts needed to provide essentially level building sites can expose the bedrock.

Septic tank absorption fields cannot function properly because of the depth to bedrock and the slope. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is IVe, nonirrigated.

48-Hartill silt loam, 25 to 40 percent slopes. This moderately deep, well drained soil is on the foot slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from phyllite and quartzite. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. When mixed to a depth of about 8 inches, the surface layer is pale brown silt loam. The upper part of the subsoil also is pale brown silt loam. It is about 4 inches thick. The lower part is light yellowish brown channery loam about 6 inches thick. The upper part of the substratum is light yellowish brown very channery loam about 9 inches thick. The lower part is very pale brown very channery loam about 9 inches thick. Phyllite is at a depth of about 36 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Included in this unit are small areas of Hartill silt loam that has a slope of less than 25 percent or more than 40 percent, Aits loam, and Newbell silt loam. Also included are Raisio channery loam on south- and west-facing slopes, Rock outcrop on knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Hartill soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, ponderosa pine, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 81. The highest average growth rate for Douglas fir is 83 cubic feet per acre per year at age 96. Based on a 50-year site curve, the mean site index for western larch is 56. The highest average growth rate for western larch is 74 cubic feet per acre per year at age 70. The typical basal area of trees is about 75 percent of that in normal stands of Douglas fir and western larch. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, ponderosa pine, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir, western larch, ponderosa pine, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the depth to bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, spirea, creambush oceanspray, Oregongrape, huckleberry, Saskatoon serviceberry, thimbleberry, rose, common snowberry, mallow ninebark, pachystima, and ceanothus. Overgrazing causes the desirable plants, such as pinegrass, mallow ninebark, rose, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting is the most effective seeding method.

The main limitations on homesites are the slope and the depth to bedrock. Special designs for buildings may be needed to overcome the slope. The cuts needed to provide essentially level building sites can expose the bedrock.

Septic tank absorption fields cannot function properly because of the depth to bedrock and the slope. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is VIe, nonirrigated.

49-Hartill silt loam, 40 to 65 percent slopes. This moderately deep, well drained soil is on the back slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from phyllite and quartzite. Slopes are convex and generally have north and east aspects at the lower elevations and south and east aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. When mixed to a depth of about 8 inches, the surface layer is pale brown silt loam. The upper part of the subsoil also is pale brown silt loam. It is about 4 inches thick. The lower part is light yellowish brown channery loam about 6 inches thick. The upper part of the substratum is light yellowish brown very channery loam about 9 inches thick. The lower part is very pale brown very channery loam about 9 inches thick. Phyllite is at a depth of about 36 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Included in this unit are small areas of Hartill silt loam that has a slope of less than 40 percent or more than 65 percent, Aits loam, and Newbell silt loam. Also included are Raisio channery loam on south- and west-facing slopes, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Hartill soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, ponderosa pine, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 81. The highest average growth rate for Douglas fir is 83 cubic feet per acre per year at age 96. Based on a 50-year site curve, the mean site index for western larch is 56. The highest average growth rate for western larch is 74 cubic feet per acre per year at age 70. The typical basal area of trees is about 75 percent of that in normal stands of Douglas fir and western larch. Per acre productivity is reduced accordingly.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, ponderosa pine, and western white pine seedlings occurs periodically. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the depth to bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, spirea, creambush oceanspray, Oregongrape, huckleberry, Saskatoon serviceberry, thimbleberry, rose, common snowberry, mallow ninebark, pachystima, and ceanothus. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, Saskatoon serviceberry, and mallow ninebark, to decrease in extent and the less desirable plants to increase. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIe, nonirrigated.

50-Hartill-Rock outcrop complex, 40 to 65 percent slopes. This map unit is on the back slopes and ridgetops of foothills and mountains. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44

degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

This unit is about 65 percent Hartill silt loam, 40 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Harrtill, silt loam that has a slope of less than 40 percent or more than 65 percent, Aits loam, and Newbell silt loam. Also included are Raisio channery loam on south- and west-facing slopes, very stony and very shallow soils near the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

This Hartill soil is moderately deep and well drained. It formed in a mantle of volcanic ash and-loess over residuum and colluvium derived dominantly from phyllite and quartzite. Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. When mixed to a depth of about 8 inches, the surface layer is pale brown silt loam. The upper part of the subsoil also is pale brown silt loam. It is about 4 inches thick. The lower part is light yellowish brown channery loam about 6 inches thick. The upper part of the substratum is light yellowish brown very channery loam about 9 inches thick. The lower part is very pale brown very channery loam about 9 inches thick. Phyllite is at a depth of about 36 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Permeability is moderate in the Hartill soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed phyllite, shale, or quartzite.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on the Hartill soil. Among the trees of limited extent are western hemlock, grand fir, ponderosa pine, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 81. The highest average growth rate for Douglas fir is 83 cubic feet per acre per year at age 96. Based on a 50-year site curve, the mean site index for western larch is 56. The highest average growth rate for western larch is 74 cubic feet per acre per year at age 70. The typical basal area of trees is about 75 percent of that in normal stands of Douglas fir and western larch, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are the Rock outcrop and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir, western larch, ponderosa pine, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed. Because the rooting depth is restricted by the depth to bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, spirea, creambush oceanspray, Oregongrape, huckleberry, Saskatoon serviceberry, thimbleberry, rose, common snowberry, mallow ninebark, pachystima, and ceanothus. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, Saskatoon serviceberry, and mallow ninebark, to decrease in extent and the less desirable plants to increase. A uniform distribution of grazing by domestic livestock is unlikely because of the slope and the Rock outcrop. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope and the Rock outcrop. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Hartill soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

51-Hoodoo silt loam. This very deep, poorly drained soil is adjacent to drainageways and on flood plains. Drainage has been altered by tiles. The soil formed in alluvium derived dominantly from volcanic ash. Slope is 0 to 2 percent. The native vegetation is mainly shrubs, forbs, and grasses. Elevation is 2,000 to 2,800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface layer is grayish brown silt loam about 12 inches thick. The subsurface layer is light brownish gray silt loam about 2 inches thick. The upper 31 inches of the underlying material is light gray, mottled silt loam. The lower part to a depth of 60 inches or more is light gray, mottled very fine sandy loam.

Included in this unit are small areas of Bonner silt loam, Pywell muck, Rathdrum very fine sandy loam, and Uncas muck. Included areas make up about 20 percent of the unit.

Permeability is moderate in the Hoodoo soil. Available water capacity is high. The effective rooting depth is limited by a seasonal high water table at a depth of 1 to 2 feet from February through May. The soil is subject to occasional, long periods of flooding from February through May. Runoff is very slow, and the hazard of water erosion is slight.

This unit is used for nonirrigated and irrigated crops, rangeland, hay and pasture, homesite development, recreation, watershed, and wildlife habitat. Most areas have been cleared and drained.

This unit is suited to nonirrigated and irrigated wheat, barley, oats, and grass-legume hay. The main management concerns are the seasonal wetness and the hazard of flooding. Tile drains and open ditches have been used in most areas to remove excess surface and subsurface water where suitable outlets are available. Minimum tillage helps to prevent compaction. A tillage pan forms if the soil is tilled when wet. In some years spring planting is delayed because of wetness. The risk of flooding can be reduced by protective levees, dikes, and diversions. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture and maintain good tilth. A common crop rotation is 4 to 8 years of grass-legume hay, such as clover, and 2 years of grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation and leaching of plant nutrients.

This unit is suitable as rangeland. The native vegetation includes quaking aspen, black cottonwood, tufted hairgrass, rush, reed canarygrass, clover, and sedge. Overgrazing causes the desirable plants, such as tufted hairgrass, clover, and sedge, to decrease in extent and the less desirable plants to increase. Wetness can limit access by livestock. Compaction occurs in areas that are grazed or browsed when the soil is wet. Seeding suitable plants in recently disturbed areas can help to provide desirable forage. Seedbed preparation and seeding are hindered by the seasonal wetness. A firm, well packed seedbed and a drill that has a depth regulator can improve the likelihood that seeding will be successful.

This unit is well suited to hay and pasture. The main limitation is the seasonal wetness. The seasonal wetness limits the choice of suitable plants and the period of cutting or grazing and increases the risk of winterkill. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. Periodic mowing and clipping help to maintain uniform plant growth and discourage selective grazing. Proper grazing practices, weed control, and applications of fertilizer are needed to ensure the maximum quality of forage. In some years irrigation is needed.

The main management concerns on homesites are the hazard of flooding and the seasonal wetness. Dikes and channels can protect homesites from flooding. Buildings should be constructed above the expected level of flooding. Tile drains and open ditches can lower the water table if suitable outlets are available.

Septic tank absorption fields cannot function properly because of the hazard of flooding and the seasonal wetness. The effluent can contaminate ground water.

The capability subclasses are IIIw, irrigated, and IVw, nonirrigated.

52-Huckleberry silt loam, 0 to 40 percent slopes. This moderately deep, well drained soil is on the toe slopes, foot slopes, and ridgetops of mountains. It formed in a thick mantle of volcanic ash and loess over residuum and colluvium derived dominantly from phyllite and quartzite. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 6,000 feet. The average annual precipitation is 30 to 45 inches, the average annual air temperature is about 39 degrees F, and the average growing season (at 28 degrees) is 70 to 90 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. When mixed to a depth of about 5 inches, the surface layer is yellowish brown silt loam. The upper 7 inches of the subsoil also is yellowish brown silt loam. The lower 4 inches is light

yellowish brown silt loam. The upper 6 inches of the substratum is very pale brown channery loam. The lower 8 inches is very pale brown very flaggy loam. Phyllite is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches (fig. 4). In some areas, mostly at the lowest elevations, summer temperatures are warmer.

Included in this unit are small areas of Huckleberry silt loam that has a slope of more than 40 percent, Buhrig very stony loam, Manley silt loam, and Vassar silt loam. Also included is Rock outcrop on ridges and knobs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Huckleberry soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir and Engelmann spruce are the main woodland species on this unit. Among the trees of limited extent are subalpine fir, western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 76. The highest average growth rate for Douglas fir is 73 cubic feet per acre per year at age 99. The typical basal area of trees is about 90 percent of that in a normal stand of Douglas fir. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for subalpine fir and Engelmann spruce have not been made. The forest understory is mainly creambush oceanspray, common snowberry, ceanothus, pinegrass, huckleberry, Douglas maple, mallow ninebark, Oregongrape, kinnikinnick, thimbleberry, pachystima, and elk sedge.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

Figure 4.-Profile of Huckleberry silt loam, 0 to 40 percent slopes. This soil formed in colluvium and residuum derived dominantly from shale, phyllite, and quartzite and has a mantle of volcanic ash and loess. Depth is marked in feet.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

The capability subclass is Vle, nonirrigated.

53-Huckleberry silt loam, 40 to 65 percent slopes. This moderately deep, well drained soil is on the back slopes of mountains. It formed in a thick mantle of volcanic ash and loess over residuum and colluvium derived dominantly from phyllite and quartzite. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 6,000 feet. The average annual precipitation is 30 to 45 inches, the average annual air temperature is about 39 degrees F, and the average growing season (at 28 degrees) is 70 to 90 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. When mixed to a depth of about 5 inches, the surface layer is yellowish brown silt loam. The upper 7 inches of the subsoil also is yellowish brown silt loam. The lower 4 inches is light yellowish brown silt loam. The upper 6 inches of the substratum is very pale brown channery loam. The lower 8 inches is very pale brown very flaggy loam. Phyllite is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas, mostly at the lowest elevations, summer temperatures are warmer.

Included in this unit are small areas of Huckleberry silt loam that has a slope of less than 40 percent or more than 65 percent, Buhrig very stony loam, Conto silt loam, Manley silt loam, and Vassar silt loam. Also included are Brickel stony loam on south- and west-facing shoulder slopes, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Huckleberry soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on this unit. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 76. The highest average growth rate for Douglas fir is 73 cubic feet per acre per year at age 99. Based on a 50-year site curve, the mean site index for western larch is 71. The highest average growth rate for western larch is 103 cubic feet per acre per year at age 70. The typical basal area of trees is about 90 percent of that in a normal stand of Douglas fir. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for subalpine fir and Engelmann spruce have not been made. The forest understory is mainly creambush oceanspray, common snowberry, ceanothus, pinegrass, huckleberry, Douglas maple, mallow ninebark, Oregongrape, kinnikinnick, thimbleberry, pachystima, and elk sedge.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

The capability subclass is VIle, nonirrigated.

54-Huckleberry-Rock outcrop complex, 25 to 65 percent slopes. This map unit is on the toe slopes, foot slopes, and back slopes of mountains. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 6,000 feet. The average annual precipitation is 30 to 45 inches, the average

annual air temperature is about 39 degrees F, and the average growing season (at 28 degrees) is 70 to 90 days.

This unit is about 65 percent Huckleberry silt loam, 25 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Huckleberry silt loam that has a slope of less than 25 percent or more than 65 percent, Buhrig very stony loam, Conto silt loam, Manley silt loam, and Vassar silt loam. Also included are Brickel stony loam on south- and west-facing shoulder slopes, very stony and very shallow soils near the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

This Huckleberry soil is moderately deep and well drained. It formed in a thick mantle of volcanic ash and loess over residuum and colluvium derived dominantly from phyllite and quartzite. Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. When mixed to a depth of about 5 inches, the surface layer is yellowish brown silt loam. The upper 7 inches of the subsoil also is yellowish brown silt loam. The lower 4 inches is light yellowish brown silt loam. The upper part of the substratum is very pale brown channery loam about 6 inches thick. The lower part is very pale brown very flaggy loam about 8 inches thick. Phyllite is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas, mostly at the lowest elevations, summer temperatures are warmer.

Permeability is moderate in the Huckleberry soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed shale, phyllite, or quartzite.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on the Huckleberry soil. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 76. The highest average growth rate for Douglas fir is 73 cubic feet per acre per year at age 99. Based on a 50-year site curve, the mean site index for western larch is 71. The highest average growth rate for western larch is 103 cubic feet per acre per year at age 70. The typical basal area of trees on the Huckleberry soil is about 90 percent of that in a normal stand of Douglas fir, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly. The forest understory is mainly creambush oceanspray, common snowberry, ceanothus, pinegrass, huckleberry, Douglas maple, mallow ninebark, Oregongrape, kinnikinnick, thimbleberry, pachystima, and elk sedge.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the Rock outcrop, and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer on the steeper slopes. They damage the soil less severely than conventional equipment and thus help to maintain productivity. In the less sloping areas, using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. Constructing roads on midslopes in the steeper areas requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

The Huckleberry soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

55-Inkler gravelly silt loam, 0 to 20 percent slopes. This very deep, well drained soil is on the toe slopes of foothills and mountains. It formed in glacial till and in residuum and colluvium derived dominantly from igneous or metamorphic rock. It has an admixture of volcanic ash and loess in the upper part. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, forbs, shrubs, and grasses. Elevation is 2,200 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 43 degrees F, the average growing season (at 28 degrees) is 90 to 120 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface layer is grayish brown gravelly silt loam about 5 inches thick. The upper 4 inches of the subsoil is pale brown gravelly silt loam. The lower 18 inches is light brownish gray very gravelly loam. The upper 15 inches of the substratum is grayish brown very gravelly loam. The lower part to a depth of 60 inches or more is light brownish gray very gravelly loam.

Included in this unit are small areas of Inkler gravelly silt loam that has a slope of more than 20 percent and Merkel stony sandy loam. Also included are Aits loam and Newbell silt loam on north- and east-facing slopes, Kiehl gravelly silt loam on terrace remnants, and Rock outcrop on knobs. Included areas make up about 15 percent of the unit.

Permeability is moderate in this Inkler soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir and ponderosa pine are the main woodland species on this unit. Among the trees of limited extent are western larch and lodgepole pine. Based on a 50-year site curve, the mean site index for Douglas fir is 84. The highest average growth rate for Douglas fir is 90 cubic feet per acre per year at age 94. Based on a 100-year site curve, the mean site index for ponderosa pine is 106. The highest average growth rate for ponderosa pine is 114 cubic feet per acre per year at age 40. The typical basal area of trees is about 80 percent of that in normal stands of Douglas fir and ponderosa pine. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir and ponderosa pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly ceanothus, pinegrass, mallow ninebark, Oregongrape, bluebunch wheatgrass, Idaho fescue, Saskatoon serviceberry, spirea, common snowberry, creambush oceanspray, rose, and pachystima. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Idaho fescue, pinegrass, mallow ninebark, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated barley and grass-legume hay. The main management concerns are the hazard of water erosion and the slope. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions or terraces may be needed to control erosion on cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

The main limitation on homesites is the slope. Special designs for buildings may be needed to overcome the slope.

The main limitation on sites for septic tank absorption fields is the slope. Where the slope is less than 15 percent, the absorption fields can function properly if the absorption lines are installed on the contour as needed. The absorption fields cannot function properly on the steeper slopes. As a result, the effluent can surface in downslope areas and create a health hazard.

The capability subclass is IIIe, nonirrigated.

56-Inkler gravelly silt loam, 20 to 40 percent slopes. This very deep, well drained soil is on the foot slopes of foothills and mountains. It formed in glacial till and in residuum and colluvium derived dominantly from igneous or metamorphic rock. It has an admixture of volcanic ash and loess in the upper part. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, forbs, shrubs, and grasses. Elevation is 2,200 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 43 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

Typically, the surface layer is grayish brown gravelly silt loam about 5 inches thick. The upper 4 inches of the subsoil is pale brown gravelly silt loam. The lower 18 inches is light brownish gray very gravelly loam. The upper 15 inches of the substratum is grayish brown very gravelly loam. The lower part to a depth of 60 inches or more is light brownish gray very gravelly loam.

Included in this unit are small areas of Inkler gravelly silt loam that has a slope of less than 20 percent or more than 40 percent and Merkel stony sandy loam. Also included are Aits loam and Newbell silt loam on north- and east-facing slopes, Hartill silt loam on the upper parts of the slopes, Kiehl gravelly silt loam on terrace remnants, and Rock outcrop on knobs. Included areas make up about 15 percent of the unit.

Permeability is moderate in this Inkler soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir and ponderosa pine are the main woodland species on this unit. Among the trees of limited extent are western larch and lodgepole pine. Based on a 50-year site curve, the mean site index for Douglas fir is 84. The highest average growth rate for Douglas fir is 90 cubic feet per acre per year at age 94. Based on a 100-year site curve, the mean site index for ponderosa pine is 106. The highest average growth rate for ponderosa pine is 114 cubic feet per acre per year at age 40. The typical basal area of trees is about 80 percent of that in normal stands of Douglas fir and ponderosa pine. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled or tracked equipment when the soil is moist causes compaction and the formation of ruts. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir and ponderosa pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly ceanothus, pinegrass, mallow ninebark, Oregongrape, bluebunch wheatgrass, Idaho fescue, Saskatoon serviceberry, spirea, common snowberry, creambush oceanspray, rose, and pachystima. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Idaho fescue, pinegrass, mallow ninebark, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting is the most effective seeding method.

The main limitation on homesites is the slope. Special designs for buildings may be needed to overcome the slope.

Septic tank absorption fields cannot function properly because of the slope. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is VIe, nonirrigated.

57-Inkler gravelly silt loam, 40 to 65 percent slopes. This very deep, well drained soil is on the back slopes of foothills and mountains. It formed in glacial till and in residuum and colluvium derived dominantly from igneous or metamorphic rock. It has an admixture of volcanic ash and loess in the upper part. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, forbs, shrubs, and grasses. Elevation is 2,200 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 43 degrees F,

and the average growing season (at 28 degrees) is 90 to 120 days.

Typically, the surface layer is grayish brown gravelly silt loam about 5 inches thick. The upper 4 inches of the subsoil is pale brown gravelly silt loam. The lower 18 inches is light brownish gray very gravelly loam. The upper 15 inches of the substratum is grayish brown very gravelly loam. The lower part to a depth of 60 inches or more is light brownish gray very gravelly loam.

Included in this unit are small areas of Inkler gravelly silt loam that has a slope of less than 40 percent or more than 65 percent and Merkel stony sandy loam. Also included are Aits loam and Newbell silt loam on north- and east-facing slopes, Kiehl gravelly silt loam on terrace remnants, and Rock outcrop on ridges and knobs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Inkler soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir and ponderosa pine are the main woodland species on this unit. Among the trees of limited extent are western larch and lodgepole pine. Based on a 50-year site curve, the mean site index for Douglas fir is 84. The highest average growth rate for Douglas fir is 90 cubic feet per acre per year at age 94. Based on a 100-year site curve, the mean site index for ponderosa pine is 106. The highest average growth rate for ponderosa pine is 115 cubic feet per acre per year at age 40. The typical basal area of trees is about 80 percent of that in normal stands of Douglas fir and ponderosa pine. Per acre productivity is reduced accordingly.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir and ponderosa pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly ceanothus, pinegrass, mallow ninebark, Oregongrape, bluebunch wheatgrass, Idaho fescue, Saskatoon serviceberry, spirea, common snowberry, creambush oceanspray, rose, and pachystima. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Idaho fescue, pinegrass, mallow ninebark, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIe, nonirrigated.

58-Inkler-Rock outcrop complex, 20 to 40 percent slopes. This map unit is on the foot slopes of foothills and mountains. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, forbs, shrubs, and grasses. Elevation is 2,200 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 43 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

This unit is about 65 percent Inkler gravelly silt loam, 20 to 40 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Inkler gravelly silt loam that has a slope of less than 20 percent or more than 40 percent and Merkel stony sandy loam. Also included are Aits stony loam and Newbell stony silt loam on north- and east-facing slopes, Hartill silt loam on the upper parts of the slopes, Kiehl gravelly silt loam on terrace remnants, and very stony and very shallow soils near the Rock outcrop. Included areas make up about 15 percent of the unit.

This Inkler soil is very deep and well drained. It formed in glacial till and in residuum and colluvium derived dominantly from igneous or metamorphic rock. It has an admixture of volcanic ash and loess in the upper part. Typically, the surface layer is grayish brown

gravelly silt loam about 5 inches thick. The upper 4 inches of the subsoil is pale brown gravelly silt loam. The lower 18 inches is light brownish gray very gravelly loam. The upper 15 inches of the substratum is grayish brown very gravelly loam. The lower part to a depth of 60 inches or more is light brownish gray very gravelly loam.

Permeability is moderate in the Inkler soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

The Rock outcrop consists mainly of exposed igneous and metamorphic rock.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir and ponderosa pine are the main woodland species on the Inkler soil. Among the trees of limited extent are western larch and lodgepole pine. Based on a 50-year site curve, the mean site index for Douglas fir is 84. The highest average growth rate for Douglas fir is 90 cubic feet per acre per year at age 94. Based on a 100-year site curve, the mean site index for ponderosa pine is 106. The highest average growth rate for ponderosa pine is 114 cubic feet per acre per year at age 40. The typical basal area of trees on the Inkler soil is about 80 percent of that in normal stands of Douglas fir and ponderosa pine, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the Rock outcrop, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, skid trails tend to converge. As a result, the degree of compaction is increased.

if the stand includes seed trees, natural reforestation of cutover areas by Douglas fir and ponderosa pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed.

This unit is suited to grazing and browsing. The forest understory is mainly ceanothus, pinegrass, mallow ninebark, Oregongrape, bluebunch wheatgrass, Idaho fescue, Saskatoon serviceberry, spirea, common snowberry, creambush oceanspray, rose, and pachystima. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Idaho fescue, pinegrass, mallow ninebark, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the Rock outcrop and the slope. Broadcasting is the most effective seeding method.

The Inkler soil is in capability subclass Vle, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

59-Inkler-Rock outcrop complex, 40 to 65 percent slopes. This map unit is on the back slopes of foothills and mountains. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, forbs, shrubs, and grasses. Elevation is 2,200 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 43 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

This unit is about 65 percent Inkler gravelly silt loam, 40 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Inkler gravelly silt loam that has a slope of less than 40 percent or more than 65 percent and Merkel stony sandy loam. Also included are Aits stony loam and Newbell stony silt loam on north- and east-facing slopes, Hartill silt loam on the upper parts of the slopes, Kiehl gravelly silt loam on terrace remnants, and very stony and very shallow soils near the Rock outcrop. included areas make up about 15 percent of the unit.

This Inkler soil is very deep and well drained. It formed in glacial till and in residuum and colluvium derived dominantly from igneous or metamorphic rock.

It has an admixture of volcanic ash and loess in the upper part. Typically, the surface layer is grayish brown gravelly silt loam about 5 inches thick. The upper 4 inches of the subsoil is pale brown gravelly silt loam. The lower 18 inches is light brownish gray very gravelly loam. The upper 15 inches of the substratum is grayish brown very gravelly loam. The lower part to a depth of 60 inches or more is light brownish gray very gravelly loam.

Permeability is moderate in the Inkler soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed igneous and metamorphic rock.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir and ponderosa pine are the main woodland species on the Inkler soil. Among the trees of limited extent are western larch and lodgepole pine. Based on a 50-year site curve, the mean site index for Douglas fir is 84. The highest average growth rate for Douglas fir is 90 cubic feet per acre per year at age 94. Based on a 100-year site curve, the mean site index for ponderosa pine is 106. The highest average growth rate for ponderosa pine is 114 cubic feet per acre per year at age 40. The typical basal area of trees is about 80 percent of that in normal stands of Douglas fir and ponderosa pine, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly.

The main limitation affecting timber harvesting is the Rock outcrop and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir and ponderosa pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed.

This unit is suited to grazing and browsing. The forest understory is mainly ceanothus, pinegrass, mallow ninebark, Oregongrape, bluebunch wheatgrass, Idaho fescue, Saskatoon serviceberry, spirea, common snowberry, creambush oceanspray, rose, and pachystima. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Idaho fescue, pinegrass, mallow ninebark, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. A uniform distribution of grazing by domestic livestock is unlikely because of the slope and the Rock outcrop. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered because of the Rock outcrop and the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Inkler soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

60-Kaniksu sandy loam, 0 to 15 percent slopes. This very deep, well drained soil is on terraces. It formed in sandy glacial outwash of mixed mineralogy. The outwash has an admixture of volcanic ash and loess in the upper part. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,100 to 2,600 feet. The average annual precipitation is 25 to 32 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is brown sandy loam about 7 inches thick. The subsoil is light yellowish brown sandy loam about 23 inches thick. The substratum to a depth of 60 inches or more is pale brown gravelly loamy sand.

Included in this unit are small areas of Kaniksu sandy loam that has a slope of more than 15 percent, Bonner silt loam, Dalkena fine sandy loam, Sacheen loamy fine sand, and Scotia fine sandy loam. Included areas make up about 20 percent of the unit.

Permeability is moderately rapid to a depth of 30 inches in this Kaniksu soil and rapid below that depth.

Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated and irrigated crops, homesite development, recreation, and wildlife habitat.

Ponderosa pine and Douglas fir are the main woodland species on this unit. Among the trees of limited extent is lodgepole pine. Based on a 100-year site curve, the mean site index for ponderosa pine is 122. The highest average growth rate for ponderosa pine is 146 cubic feet per acre per year at age 40. Based on a 50-year site curve, the mean site index for Douglas fir is 83. The highest average growth rate for Douglas fir is 88 cubic feet per acre per year at age 95. The typical basal area of trees is about 85 percent of that in normal stands of ponderosa pine and Douglas fir. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are the surface layer of sandy loam and snowpack in winter. Using standard wheeled and tracked equipment causes the formation of ruts and displacement of the surface layer when the soil is dry. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine and Douglas fir occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly elk sedge, pinegrass, common snowberry, Oregongrape, ceanothus, bluebunch wheatgrass, white spirea, rose, and creambush oceanspray. Overgrazing causes the desirable plants, such as pinegrass, bluebunch wheatgrass, and elk sedge, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated and irrigated wheat, barley, oats, and grass-legume hay. The main management concerns are the low available water capacity, the hazard of water erosion, and the slope. The crops that are tolerant of drought grow best. The amount of available moisture is not adequate for most other crops to grow well. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Stripcropping and diversions or terraces may be needed to control water erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

The main limitations on homesites are the slope and the instability of cutbanks. Special designs for buildings may be needed to overcome the slope. The sides of shallow excavations can cave in unless they are supported by special retainer walls.

The main limitations on sites for septic tank absorption fields are the slope and the rapid permeability in the substratum. Where the slope is a concern, the absorption lines should be installed on the contour. Seepage can contaminate ground water because of the rapid permeability.

The capability subclasses are IIIe, irrigated, and lVe, nonirrigated.

61-Kaniksu sandy loam, 15 to 40 percent slopes. This very deep, well drained soil is on terrace escarpments. It formed in sandy glacial outwash of mixed mineralogy. The outwash has an admixture of volcanic ash and loess in the upper part. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,100 to 2,600 feet. The average annual precipitation is 25 to 32 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is brown sandy loam about 7 inches thick. The subsoil is light yellowish brown sandy loam about 23 inches thick. The substratum to a depth of 60 inches or more is pale brown gravelly loamy sand.

Included in this unit are small areas of Kaniksu sandy loam that has a slope of less than 15 percent or more than 40 percent, Dalkena fine sandy loam, Orwig sandy loam, Sacheen loamy fine sand, and Scotia fine sandy loam. Included areas make up about 15 percent of the unit.

Permeability is moderately rapid to a depth of 30 inches in this Kaniksu soil and rapid below that depth. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Ponderosa pine and Douglas fir are the main woodland species on this unit. Among the trees of limited extent is lodgepole pine. Based on a 100-year site curve, the mean site index for ponderosa pine is 122. The highest average growth rate for ponderosa pine is 146 cubic feet per acre per year at age 40. Based on a 50-year site curve, the mean site index for Douglas fir is 83. The highest average growth rate for Douglas fir is 88 cubic feet per acre per year at age 95. The typical basal area of trees is about 85 percent of that in normal stands of ponderosa pine and Douglas fir. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are the surface layer of sandy loam, snowpack in winter, and the slope, which hinders the use of skidding equipment. When dry, the loose surface layer hinders the use of wheeled equipment. Using standard wheeled and tracked equipment causes the formation of ruts and displacement of the surface layer when the soil is dry. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. Occasional snowpack hinders the use of equipment in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine and Douglas fir occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. The low available water capacity can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly elk sedge, pinegrass, common snowberry, Oregongrape, ceanothus, bluebunch wheatgrass, white spirea, rose, and creambush oceanspray. Overgrazing causes the desirable plants, such as pinegrass, bluebunch wheatgrass, and elk sedge, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting is the most effective seeding method.

The main limitations on homesites are the slope and the instability of cutbanks. Special designs for buildings may be needed to overcome the slope. The sides of shallow excavations can cave in unless they are supported by special retainer walls.

Septic tank absorption fields cannot function properly because of the slope and the rapid permeability in the substratum. The effluent can surface in downslope areas and create a health hazard. Seepage can contaminate ground water because of the rapid permeability.

The capability subclass is VIe, nonirrigated.

62-Kegel loam. This very deep, somewhat poorly drained soil is on the flood plains adjacent to streams. It formed in alluvium of mixed mineralogy. Slope is 0 to 3 percent. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,000 feet. The average annual precipitation is 22 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 80 to 100 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is dark grayish brown loam about 12 inches thick. The subsurface layer is grayish brown loam about 4 inches thick. The next layer is pale brown gravelly sandy loam about 4 inches thick. Below this is a buried surface layer of grayish brown, mottled sandy loam about 10 inches thick. The underlying material to a depth of 60 inches or more is light olive brown, mottled very gravelly sandy loam.

Included in this unit are small areas of Blueslide silt loam, Bonner silt loam, Martella silt loam, and Rathdrum very fine sandy loam. Also included are poorly drained soils. Included areas make up about 15 percent of the unit.

Permeability is moderate to a depth of 30 inches in this Kegel soil and rapid below that depth. Available water capacity is moderate. The effective rooting depth is limited by a seasonal high water table at a depth of 0.5 foot to 2.0 feet from January through June. The soil is subject to occasional, brief periods of flooding from March through June. Channeling and deposition are common along streambanks. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for grazable woodland, nonirrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Ponderosa pine and Douglas fir are the main

woodland species on this unit. Among the trees of limited extent is lodgepole pine. Based on a 100-year site curve, the estimated mean site index for ponderosa pine is 99. The highest average growth rate for ponderosa pine is 100 cubic feet per acre per year at age 40. Estimates of the site index and growth rate for Douglas fir have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. If roads are constructed on this unit, additional rock is needed to improve the ability of the soil to support equipment. When wet, unsurfaced roads are soft and slippery and can be impassable. The seasonal high water table restricts the use of equipment to periods when the soil is dry in the upper part or when it is protected by snowpack. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine and Douglas fir occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. The flooding and the seasonal high water table, which hinder root respiration, may result in a low seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and prevent the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the seasonal high water table, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly sedge, western brackenfern, Oregongrape, common snowberry, brome, strawberry, rose, huckleberry, kinnikinnick, thimbleberry, longtube twinflower, and arnica. Overgrazing causes the desirable plants, such as brome, sedge, and huckleberry, to decrease in extent and the less desirable plants to increase. Wetness can limit access by livestock. Compaction occurs in areas that are grazed or browsed when the soil is wet. Seeding suitable plants in recently disturbed areas can help to provide desirable forage. Seedbed preparation and seeding are hindered by the seasonal wetness. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated oats and grass-legume hay. The main management concerns are the seasonal wetness and the hazard of flooding. Tile drains and open ditches have been used in most areas to remove excess surface and subsurface water where suitable outlets are available. Minimum tillage helps to prevent compaction. A tillage pan forms if the soil is tilled when wet. In some years spring planting is delayed because of wetness. The risk of flooding can be reduced by protective levees, dikes, and diversions. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture and maintain good tilth. A common crop rotation is 4 to 8 years of grass-legume hay, such as clover, and 2 years of grain.

The main management concerns on homesites are the hazard of flooding, the seasonal wetness, and the instability of cutbanks. Dikes and channels can protect homesites from flooding. Buildings should be constructed above the expected level of flooding. Tile drains and open ditches can lower the water table if suitable outlets are available. The sides of shallow excavations can cave in unless they are supported by special retainer walls.

Septic tank absorption fields cannot function properly because of the seasonal wetness, the hazard of flooding, and the rapid permeability in the substratum.

The capability subclass is IVw, nonirrigated.

63-Kiehl gravelly silt loam, 0 to 10 percent slopes. This very deep, well drained soil is on terraces. It formed in a thin mantle of volcanic ash and loess over glacial outwash of mixed mineralogy. The native vegetation is mainly conifers, forbs, grasses, and shrubs. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 2 inches thick. The surface layer is brown gravelly silt loam about 5 inches thick. The subsoil is light yellowish brown gravelly fine sandy loam about 15 inches thick. The substratum to a depth of 60 inches or more is very pale brown extremely gravelly loamy coarse sand.

Included in this unit are small areas of Kiehl gravelly silt loam that has a slope of more than 10 percent, Bonner gravelly silt loam, Bonner silt loam, and Eloika silt loam. Also included is Rathdrum very fine sandy loam in depressions. Included areas make up about 20 percent of the unit.

Permeability is moderately rapid to a depth of 20 inches in this Kiehl soil and rapid below that depth. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the

hazard of water erosion is slight.

This unit is used for grazable woodland, nonirrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, ponderosa pine, western larch, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent is grand fir. Based on a 50-year site curve, the mean site index for Douglas fir is 83. The highest average growth rate for Douglas fir is 88 cubic feet per acre per year at age 95. Based on a 100-year site curve, the mean site index for ponderosa pine is 106. The highest average growth rate for ponderosa pine is 114 cubic feet per acre per year at age 40. The typical basal area of trees is about 60 percent of that in normal stands of Douglas fir and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western larch and lodgepole pine have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, western larch, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. The survival rate of naturally established Douglas fir and ponderosa pine seedlings may be low if the gravelly silt loam in the surface layer and in the upper part of the subsoil has been displaced by logging.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, common snowberry, Oregongrape, creambush oceanspray, mallow ninebark, strawberry, longtube twinflower, rose, spirea, Saskatoon serviceberry, ceanothus, and pachystima. Overgrazing causes the desirable plants, such as pinegrass. creambush oceanspray, mallow ninebark, and Saskatoon serviceberry, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated barley and grass-legume hay. The main management concerns are the low available water capacity, the hazard of water erosion, and the slope. The crops that are tolerant of drought grow best. The amount of available moisture is not adequate for most other crops to grow well. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Stripcropping and diversions or terraces may be needed to control erosion on cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

The main limitations on homesites are the slope and the instability of cutbanks. Special designs for buildings may be needed to overcome the slope. The sides of shallow excavations can cave in unless they are supported by special retainer walls.

The main limitations on sites for septic tank absorption fields are the slope and the rapid permeability in the substratum. Where the slope is a concern, the absorption lines should be installed on the contour. Seepage can contaminate ground water because of the rapid permeability.

The capability subclass is IIIe, nonirrigated.

64-Manley silt loam, 0 to 40 percent slopes. This very deep, well drained soil is on the toe slopes, foot slopes, and ridgetops of mountains. It formed in a thick mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are convex or concave and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,500 to 6,500 feet. The average annual precipitation is 28 to 45 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 80 to 90 days.

Typically, the surface is covered with a mat of organic material about 2 inches thick. When mixed to a depth of about 8 inches, the surface layer is brown silt loam. The subsoil also is brown silt loam. It is about 8 inches thick. The upper 10 inches of the substratum is light yellowish brown very gravelly sandy loam. The lower part to a depth of 60 inches or more is very pale brown very gravelly sandy loam.

Included in this unit are small areas of Manley silt loam that has a slope of more than 40 percent, Conto

silt loam, Sherlock silt loam, and Vassar silt loam. Also included are Buhrig very stony loam and Huckleberry silt loam on ridgetops, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Manley soil. Available water capacity is moderate or high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on this unit. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 79. The highest average growth rate for Douglas fir is 79 cubic feet per acre per year at age 98. Based on a 50-year site curve, the mean site index for western larch is 70. The highest average growth rate for western larch is 101 cubic feet per acre per year at age 70. Estimates of the site index and growth rate for subalpine fir and Engelmann spruce have not been made. The forest understory is mainly pinegrass, Saskatoon serviceberry, Oregongrape, ceanothus, mallow ninebark, pachystima, thimbleberry, huckleberry, elk sedge, kinnikinnick, rose, and creambush oceanspray.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

The capability subclass is VIs, nonirrigated.

65-Manley silt loam, 40 to 65 percent slopes. This very deep, well drained soil is on the back slopes of mountains. It formed in a thick mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are convex or concave and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,500 to 6,500 feet. The average annual precipitation is 28 to 45 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 80 to 90 days.

Typically, the surface is covered with a mat of organic material about 2 inches thick. When mixed to a depth of about 8 inches, the surface layer is brown silt loam. The subsoil also is brown silt loam. It is about 8 inches thick. The upper 10 inches of the substratum is light yellowish brown very gravelly sandy loam. The lower part to a depth of 60 inches or more is very pale brown very gravelly sandy loam.

Included in this unit are small areas of Manley silt loam that has a slope of less than 40 percent or more than 65 percent, Conto silt loam, Sherlock silt loam, and Vassar silt loam. Also included are Buhrig very stony loam and Huckleberry silt loam on the upper parts of the slopes, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Manley soil. Available water capacity is moderate or high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on this unit. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 79. The highest average growth rate for Douglas fir is 79 cubic feet per acre per year at age 98. Based on a 50-year site curve, the mean site index for western larch is 70. The highest average growth rate for western larch is 101 cubic feet per acre per year at age 70. Estimates of the site index and growth rate for subalpine fir and Engelmann spruce have not been made. The forest understory is mainly pinegrass, Saskatoon serviceberry, Oregongrape,

ceanothus, mallow ninebark, pachystima, thimbleberry, huckleberry, elk sedge, kinnikinnick, rose, and creambush oceanspray.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

The capability subclass is VIIe, nonirrigated.

66-Manley bouldery silt loam, 25 to 40 percent slopes. This very deep, well drained soil is on the toe slopes, foot slopes, and ridgetops of mountains. It formed in a thick mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are convex or concave and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,500 to 6,500 feet. The average annual precipitation is 28 to 45 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 80 to 90 days.

Typically, the surface is covered with a mat of organic material about 2 inches thick. When mixed to a depth of about 8 inches, the surface layer is brown bouldery silt loam. The subsoil also is brown bouldery silt loam. It is about 8 inches thick. The upper 10 inches of the substratum is light yellowish brown very gravelly sandy loam. The lower part to a depth of 60 inches or more is very pale brown very gravelly sandy loam.

Included in this unit are small areas of Manley bouldery silt loam that has a slope of less than 25 percent or more than 40 percent and Vassar silt loam. Also included are Buhrig very stony loam and Huckleberry silt loam on ridgetops, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Manley soil. Available water capacity is moderate or high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on this unit. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 79. The highest average growth rate for Douglas fir is 79 cubic feet per acre per year at age 98. Based on a 50-year site curve, the mean site index for western larch is 70. The highest average growth rate for western larch is 101 cubic feet per acre per year at age 70. Estimates of the site index and growth rate for subalpine fir and Engelmann spruce have not been made. The forest understory is mainly pinegrass, Saskatoon serviceberry, mallow ninebark, ceanothus, Oregongrape, elk sedge, pachystima, kinnikinnick, thimbleberry, huckleberry, rose, and creambush oceanspray.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the boulders, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter. The boulders on the surface can hinder harvesting. Also, falling timber can break on the boulders.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine

seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

The capability subclass is VIe, nonirrigated.

67-Manley bouldery silt loam, 40 to 65 percent slopes. This very deep, well drained soil is on the back slopes of mountains. It formed in a thick mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are convex or concave and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,500 to 6,500 feet. The average annual precipitation is 28 to 45 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 80 to 90 days.

Typically, the surface is covered with a mat of organic material about 2 inches thick. When mixed to a depth of about 8 inches, the surface layer is brown bouldery silt loam. The subsoil also is brown bouldery silt loam. It is about 8 inches thick. The upper 10 inches of the substratum is light yellowish brown very gravelly sandy loam. The lower part to a depth of 60 inches or more is very pale brown very gravelly sandy loam.

Included in this unit are small areas of Manley bouldery silt loam that has a slope of less than 40 percent or more than 65 percent and Vassar silt loam. Also included are Buhrig very stony loam and Huckleberry silt loam on the upper parts of the slopes, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Manley soil. Available water capacity is moderate or high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on this unit. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 79. The highest average growth rate for Douglas fir is 79 cubic feet per acre per year at age 98. Based on a 50-year site curve, the mean site index for western larch is 70. The highest average growth rate for western larch is 101 cubic feet per acre per year at age 70. Estimates of the site index and growth rate for subalpine fir and Engelmann spruce have not been made. The forest understory is mainly pinegrass, Saskatoon serviceberry, mallow ninebark, ceanothus, Oregongrape, elk sedge, pachystima, kinnikinnick, thimbleberry, huckleberry, rose, and creambush oceanspray.

The main limitations affecting timber harvesting are the boulders and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter. The boulders on the surface can hinder harvesting. Also, falling timber can break on the boulders.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

The capability subclass is VIIe, nonirrigated.

68-Manley-Rock outcrop complex, 0 to 40 percent slopes. This map unit is on the toe slopes, foot slopes, and ridgetops of mountains. Slopes are convex or concave and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,500 to 6,500 feet. The average annual precipitation is 28 to 45 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 80 to 90 days.

This unit is about 65 percent Manley silt loam, 0 to 40 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Manley silt loam that has a slope of more than 40 percent and Vassar silt loam. Also included are Buhrig very stony loam and Huckleberry silt loam on ridgetops, very stony and very shallow soils near the Rock outcrop, and

poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

This Manley soil is very deep and well drained. It formed in a thick mantle of volcanic ash and loess over glacial till of mixed mineralogy. Typically, the surface is covered with a mat of organic material about 2 inches thick. When mixed to a depth of about 8 inches, the surface layer is brown silt loam. The subsoil also is brown silt loam. It is about 8 inches thick. The upper 10 inches of the substratum is light yellowish brown very gravelly sandy loam. The lower part to a depth of 60 inches or more is very pale brown very gravelly sandy loam.

Permeability is moderate in the Manley soil. Available water capacity is moderate or high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

The Rock outcrop consists mainly of exposed granitic rock.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on this unit. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 79. The highest average growth rate for Douglas fir is 79 cubic feet per acre per year at age 98. Based on a 50-year site curve, the mean site index for western larch is 70. The highest average growth rate for western larch is 101 cubic feet per acre per year at age 70. The Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for subalpine fir and Engelmann spruce have not been made. The forest understory is mainly pinegrass, Saskatoon serviceberry, Oregongrape. ceanothus, mallow ninebark, pachystima, thimbleberry, huckleberry, elk sedge, kinnikinnick, rose, and creambush oceanspray.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the Rock outcrop, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed.

The Manley soil is in capability subclass Vle, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

69-Manley-Rock outcrop complex, 40 to 65 percent slopes. This map unit is on the back slopes of mountains. Slopes are convex or concave and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,500 to 6,500 feet. The average annual precipitation is 28 to 45 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 80 to 90 days.

This unit is about 65 percent Manley silt loam, 40 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Manley silt loam that has a slope of less than 40 percent or more than 65 percent and Vassar silt loam. Also included are Buhrig very stony loam and Huckleberry silt loam on the upper parts of the slopes, very stony and very shallow soils near the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

This Manley soil is very deep and well drained. It formed in a thick mantle of volcanic ash and loess over glacial till of mixed mineralogy. Typically, the surface is covered with a mat of organic material about 2 inches thick. When mixed to a depth of about 8 inches, the surface layer is brown silt loam. The subsoil also is brown silt loam. It is about 8 inches thick. The upper 10

inches of the substratum is light yellowish brown very gravelly sandy loam. The lower part to a depth of 60 inches or more is very pale brown very gravelly sandy loam.

Permeability is moderate in the Manley soil. Available water capacity is moderate or high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed granitic rock.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on the Manley soil. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 79. The highest average growth rate for Douglas fir is 79 cubic feet per acre per year at age 98. Based on a 50-year site curve, the mean site index for western larch is 70. The highest average growth rate for western larch is 101 cubic feet per acre per year at age 70. The Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for subalpine fir and Engelmann spruce have not been made. The forest understory is mainly pinegrass, Saskatoon serviceberry, Oregongrape, ceanothus, mallow ninebark, pachystima, thimbleberry, huckleberry, elk sedge, kinnikinnick, rose, and creambush oceanspray.

The main limitations affecting timber harvesting are the Rock outcrop and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed.

The Manley soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

70-Martella silt loam, 0 to 5 percent slopes. This very deep, moderately well drained soil is on terraces. It formed in a mantle of volcanic ash and loess over silty glacial lake sediments. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 22 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. When mixed to a depth of about 7 inches, the surface layer is pale brown silt loam. The upper part of the subsoil also is pale brown silt loam. It is about 6 inches thick. The next part is light brownish gray silty clay loam about 9 inches thick. The lower part is pale brown very fine sandy loam about 10 inches thick. The upper 7 inches of the substratum is light yellowish brown, stratified silt loam. The lower part to a depth of 60 inches or more is light brownish gray, stratified silt loam.

Included in this unit are small areas of Martella silt loam that has a slope of more than 7 percent, Anglen silt loam, Bonner silt loam, Dalkena fine sandy loam, and Scotia fine sandy loam. Also included are poorly drained soils in depressions. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Martella soil. Available water capacity is high. The effective rooting depth is limited by a perched seasonal high water table at a depth of 2 to 3 feet from February through April. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for nonirrigated and irrigated crops, grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

This unit is suited to nonirrigated and irrigated wheat, barley, and grass-legume hay. The main management concern is the hazard of water erosion. Minimum tillage helps to prevent compaction. A tillage pan forms if the soil is tilled when wet. In some years spring planting is

delayed because of wetness. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Stripcropping and diversions or terraces may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. Some areas are seepy. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

Douglas fir, ponderosa pine, western larch, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent are western redcedar, grand fir, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 73. The highest average growth rate for Douglas fir is 67 cubic feet per acre per year at age 108. Based on a 100-year site curve, the mean site index for ponderosa pine is 110. The highest average growth rate for ponderosa pine is 122 cubic feet per acre per year at age 40. The typical basal area of trees is about 70 percent of that in normal stands of Douglas fir and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western larch and lodgepole pine have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, western larch, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the stratified substratum and the perched seasonal high water table, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly common snowberry, spirea, ceanothus, Oregongrape, creambush oceanspray, pinegrass, strawberry, rose, thimbleberry, mallow ninebark, Saskatoon serviceberry, and kinnikinnick. Overgrazing causes the desirable plants, such as pinegrass, Saskatoon serviceberry, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Wetness can limit access by livestock. Compaction can occur in areas that are grazed or browsed when the soil is wet. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the seasonal wetness. Broadcasting is the most effective seeding method.

The main limitation on homesites is the seasonal wetness. A drainage system is needed on sites for buildings with basements and crawl spaces because of the perched seasonal high water table.

The main limitations on sites for septic tank absorption fields are the moderately slow permeability and the seasonal wetness. Installing interceptor drains, adding topsoil, and installing longer absorption lines on the contour help to compensate for these limitations.

The capability subclass is IIIe, irrigated, and IIIw, nonirrigated.

71-Martella silt loam, 5 to 15 percent slopes. This very deep, moderately well drained soil is on terraces. It formed in a mantle of volcanic ash and loess over silty glacial lake sediments. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 22 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. When mixed to a depth of about 7 inches, the surface layer is pale brown silt loam. The upper part of the subsoil also is pale brown silt loam. It is about 6 inches thick. The next part is light brownish gray silty clay loam about 9 inches thick. The lower part is pale brown very fine sandy loam about 10 inches thick. The upper 7 inches of the substratum is light yellowish brown, stratified silt loam. The lower part to a depth of 60 inches or more is light brownish gray, stratified silt loam.

Included in this unit are small areas of Martella silt loam that has a slope of less than 5 percent or more than 15 percent, Anglen silt loam, Bonner silt loam, Dalkena fine sandy loam, and Scotia fine sandy loam. Also included are poorly drained soils in depressions. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Martella soil. Available water capacity is high. The effective rooting depth is limited by a perched seasonal high water table at a depth of 2 to 3 feet from February through April. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for nonirrigated and irrigated crops, grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

This unit is suited to nonirrigated and irrigated wheat, barley, and grass-legume hay. The main management concerns are the seasonal wetness, the hazard of water erosion, and the slope. Minimum tillage helps to prevent compaction. A tillage pan forms if the soil is tilled when wet. In some years spring planting is delayed because of wetness. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. Some areas are seepy. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

Douglas fir, ponderosa pine, western larch, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent are western redcedar, grand fir, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 73. The highest average growth rate for Douglas fir is 67 cubic feet per acre per year at age 108. Based on a 100-year site curve, the mean site index for ponderosa pine is 110. The highest average growth rate for ponderosa pine is 122 cubic feet per acre per year at age 40. The typical basal area of trees is about 70 percent of that in normal stands of Douglas fir and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western larch and lodgepole pine have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, western larch, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the stratified substratum and the perched seasonal high water table, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly common snowberry, spirea, creambush oceanspray, pinegrass, strawberry, rose, thimbleberry, mallow ninebark, Saskatoon serviceberry, and kinnikinnick. Overgrazing causes the desirable plants, such as pinegrass, Saskatoon serviceberry, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Wetness can limit access by livestock. Compaction can occur in areas that are grazed or browsed when the soil is wet. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the seasonal wetness. Broadcasting is the most effective seeding method.

The main limitations on homesites are the slope and the seasonal wetness. Special designs for buildings may be needed to overcome the slope. A drainage system is needed on sites for buildings with basements and crawl spaces because of the perched seasonal high water table.

The main limitations on sites for septic tank absorption fields are the slope, the moderately slow permeability, and the seasonal wetness. Where the slope is a concern, the absorption lines should be installed on the contour. Installing interceptor drains,

adding topsoil, and installing longer absorption lines on the contour help to compensate for the limitations of this soil.

The capability subclasses are IVe, irrigated, and Ille, nonirrigated.

72-Martella silt loam, 15 to 25 percent slopes. This very deep, moderately well drained soil is on terraces. It formed in a mantle of volcanic ash and loess over silty glacial lake sediments. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 22 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. When mixed to a depth of about 7 inches, the surface layer is pale brown silt loam. The upper part of the subsoil also is pale brown silt loam. It is about 6 inches thick. The next part is light brownish gray silty clay loam about 9 inches thick. The lower part is pale brown very fine sandy loam about 10 inches thick. The upper 7 inches of the substratum is light yellowish brown, stratified silt loam. The lower part to a depth of 60 inches or more is light brownish gray, stratified silt loam.

Included in this unit are small areas of Martella silt loam that has a slope of less than 15 percent or more than 25 percent, Anglen silt loam, Bonner silt loam, Dalkena fine sandy loam, and Scotia fine sandy loam. Also included are poorly drained soils in depressions. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Martella soil. Available water capacity is high. The effective rooting depth is limited by a perched seasonal high water table at a depth of 2 to 3 feet from February through April. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for nonirrigated and irrigated crops, grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

This unit is suited to nonirrigated and irrigated wheat, barley, and grass-legume hay. The main management concerns are the seasonal wetness, the hazard of water erosion, and the slope. Minimum tillage helps to prevent compaction. A tillage pan forms if the soil is tilled when wet. In some years spring planting is delayed because of wetness. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth. and control erosion. Divided-slope farming and stripcropping may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. Some areas are seepy. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

Douglas fir, ponderosa pine, western larch, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent are western redcedar, grand fir, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 73. The highest average growth rate for Douglas fir is 67 cubic feet per acre per year at age 108. Based on a 100-year site curve, the mean site index for ponderosa pine is 110. The highest average growth rate for ponderosa pine is 122 cubic feet per acre per year at age 40. The typical basal area of trees is about 70 percent of that in normal stands of Douglas fir and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western larch and lodgepole pine have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, western larch, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the stratified substratum and the perched seasonal high water table, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly common snowberry, spirea,

creambush oceanspray, pinegrass, strawberry, rose, thimbleberry, mallow ninebark, Saskatoon serviceberry, and kinnikinnick. Overgrazing causes the desirable plants, such as pinegrass, Saskatoon serviceberry, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Wetness can limit access by livestock. Compaction can occur in areas that are grazed or browsed when the soil is wet. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the seasonal wetness. Broadcasting is the most effective seeding method.

The main limitations on homesites are the slope and the seasonal wetness. Special designs for buildings may be needed to overcome the slope. A drainage system is needed on sites for buildings with basements and crawl spaces because of the perched seasonal high water table.

Septic tank absorption fields cannot function properly because of the slope, the moderately slow permeability, and the seasonal wetness. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is VIe, irrigated, and IVe, nonirrigated.

73-Martella silt loam, 25 to 40 percent slopes. This very deep, moderately well drained soil is on terrace escarpments. It formed in a mantle of volcanic ash and loess over silty glacial lake sediments. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 22 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. When mixed to a depth of about 7 inches, the surface layer is pale brown silt loam. The upper part of the subsoil also is pale brown silt loam. It is about 6 inches thick. The next part is light brownish gray silty clay loam about 9 inches thick. The lower part is pale brown very fine sandy loam about 10 inches thick. The upper 7 inches of the substratum is light yellowish brown, stratified silt loam. The lower part to a depth of 60 inches or more is light brownish gray, stratified silt loam.

Included in this unit are small areas of Martella silt loam that has a slope of less than 25 percent or more than 40 percent, Aits loam, Anglen silt loam, Dalkena fine sandy loam, Newbell silt loam, and Scotia fine sandy loam. Also included are poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Martella soil. Available water capacity is high. The effective rooting depth is limited by a perched seasonal high water table at a depth of 2 to 3 feet from February through April. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, ponderosa pine, western larch, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent are western redcedar, grand fir, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 73. The highest average growth rate for Douglas fir is 67 cubic feet per acre per year at age 108. Based on a 100-year site curve, the mean site index for ponderosa pine is 110. The highest average growth rate for ponderosa pine is 122 cubic feet per acre per year at age 40. The typical basal area of trees is about 70 percent of that in normal stands of Douglas fir and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western larch and lodgepole pine have not been made.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, western larch, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the stratified substratum and the perched seasonal high water table, the trees

are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly common snowberry, spirea, creambush oceanspray, pinegrass, strawberry, rose, thimbleberry, mallow ninebark, Saskatoon serviceberry. and kinnikinnick. Overgrazing causes the desirable plants, such as pinegrass, Saskatoon serviceberry, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Wetness can limit access by livestock. Compaction can occur in areas that are grazed or browsed when the soil is wet. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the seasonal wetness and the slope. Broadcasting is the most effective seeding method.

The main limitations on homesites are the slope and the seasonal wetness. Special designs for buildings may be needed to overcome the slope. A drainage system is needed on sites for buildings with basements and crawl spaces.

Septic tank absorption fields cannot function properly because of the slope, the seasonal wetness, and the moderately slow permeability. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is Vle, nonirrigated.

74-Merkel stony sandy loam, 0 to 40 percent slopes. This very deep, well drained soil is on the toe slopes and foot slopes of foothills and mountains. It formed in glacial till derived dominantly from granitic rock. The till has an admixture of volcanic ash and loess in the upper part. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 43 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 5 inches, the surface layer is light yellowish brown stony sandy loam. The upper 10 inches of the subsoil also is light yellowish brown stony sandy loam. The lower 8 inches is pale brown very cobbly sandy loam. The upper 7 inches of the substratum is very pale brown very cobbly sandy loam. The lower part to a depth of 60 inches or more is very pale brown very cobbly coarse sandy loam.

Included in this unit are small areas of Merkel stony sandy loam that has a slope of more than 40 percent, Aits stony loam, and Newbell stony silt loam. Also included are Bonner gravelly silt loam, Kiehl gravelly silt loam. Martella silt loam, and Scrabblers silt loam on terrace remnants. Included areas make up about 15 percent of the unit.

Permeability is moderately rapid in this Merkel soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and ponderosa pine are the main woodland species on this unit. Among the trees of limited extent are western redcedar, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 78. The highest average growth rate for Douglas fir is 77 cubic feet per acre per year at age 98. Based on a 50-year site curve, the mean site index for western larch is 72. The highest average growth rate for western larch is 105 cubic feet per acre per year at age 70. The typical basal area of trees is about 90 percent of that in normal stands of Douglas fir and western larch. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are the surface layer of sandy loam, snowpack in winter, the stones, and the slope, which hinders the use of skidding equipment. When dry, the loose surface layer hinders the use of wheeled equipment. Using standard wheeled and tracked equipment causes the formation of ruts and displacement of the surface layer when the soil is dry. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. Occasional snowpack hinders the use of equipment in winter. The stones on the surface can hinder harvesting. Also. falling timber can break on the stones.

Steep skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and ponderosa pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, western larch, or ponderosa pine seedlings. The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The

forest understory is mainly creambush oceanspray, common snowberry, pinegrass, ceanothus, kinnikinnick, pachystima, Oregongrape, huckleberry, elk sedge, spirea, mallow ninebark, and Saskatoon serviceberry. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, mallow ninebark, and Saskatoon serviceberry, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope and by the stones on the surface. Broadcasting is the most effective seeding method.

The main limitations on homesites are the slope, the instability of cutbanks, and large stones. Special designs for buildings may be needed to overcome the slope. The sides of shallow excavations can cave in unless they are supported by special retainer walls. The large stones can interfere with excavation.

The main limitations on sites for septic tank absorption fields are the slope and the large stones. Where the slope is less than 15 percent, the absorption fields can function properly if the absorption lines are installed on the contour as needed. The absorption fields cannot function properly on the steeper slopes. As a result, the effluent can surface in downslope areas and create a health hazard. The stones can interfere with the installation of the absorption lines. Seepage can contaminate ground water because the substratum is moderately rapidly permeable.

The capability subclass is Vle, nonirrigated.

75-Merkel stony sandy loam, 40 to 65 percent slopes. This very deep, well drained soil is on the back slopes of foothills and mountains. It formed in glacial till derived dominantly from granitic rock. The till has an admixture of volcanic ash and loess in the upper part. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 43 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 5 inches, the surface layer is light yellowish brown stony sandy loam. The upper 10 inches of the subsoil also is light yellowish brown stony sandy loam. The lower 8 inches is pale brown very cobbly sandy loam. The upper 7 inches of the substratum is very pale brown very cobbly sandy loam. The lower part to a depth of 60 inches or more is very pale brown very cobbly coarse sandy loam.

Included in this unit are small areas of Merkel stony sandy loam that has a slope of less than 40 percent or more than 65 percent, Aits stony loam, and Newbell stony silt loam. Also included are Bonner gravelly silt loam, Kiehl gravelly silt loam, Martella silt loam, and Scrabblers silt loam on terrace remnants. Included areas make up about 15 percent of the unit.

Permeability is moderately rapid in this Merkel soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and ponderosa pine are the main woodland species on this unit. Among the trees of limited extent are western redcedar, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 78. The highest average growth rate for Douglas fir is 77 cubic feet per acre per year at age 98. Based on a 50-year site curve, the mean site index for western larch is 72. The highest average growth rate for western larch is 105 cubic feet per acre per year at age 70. The typical basal area of trees is about 90 percent of that in normal stands of Douglas fir and western larch. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are the stones, the surface layer of sandy loam, and the slope, which restricts the use of skidding equipment. When dry, the loose surface layer hinders the use of wheeled equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. Occasional snowpack hinders the use of equipment in winter. The stones on the surface can hinder harvesting. Also, falling timber can break on the stones.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and ponderosa pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, western larch, or ponderosa pine seedlings. The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of

natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly creambush oceanspray, common snowberry, pinegrass, ceanothus, kinnikinnick, pachystima, Oregongrape, huckleberry, elk sedge, spirea, mallow ninebark, and Saskatoon serviceberry. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Overgrazing causes the desirable plants, such as creambush oceanspray, pinegrass, elk sedge, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope and by the stones on the surface. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIe, nonirrigated.

76-Merkel-Rock outcrop complex, 10 to 65 percent slopes. This map unit is on the back slopes of foothills and mountains. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 43 degrees F. and the average growing season (at 28 degrees) is 90 to 110 days.

This unit is about 65 percent Merkel stony sandy loam, 10 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Merkel stony sandy loam that has a slope of less than 10 percent or more than 65 percent, Aits stony loam, and Newbell stony silt loam. Also included are Bonner silt loam, Kiehl gravelly silt loam. Martella silt loam, and Scrabblers silt loam on terrace remnants and very stony and very shallow soils near the Rock outcrop. Included areas make up about 15 percent of the unit.

This Merkel soil is very deep and well drained. It formed in glacial till derived dominantly from granitic rock. The till has an admixture of volcanic ash and loess in the upper part. Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 5 inches, the surface layer is light yellowish brown stony sandy loam. The upper 10 inches of the subsoil also is light yellowish brown stony sandy loam. The lower 8 inches is pale brown very cobbly sandy loam. The upper 7 inches of the substratum is very pale brown very cobbly sandy loam. The lower part to a depth of 60 inches or more is very pale brown very cobbly coarse sandy loam.

Permeability is moderately rapid in the Merkel soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed granitic rock.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and ponderosa pine are the main woodland species on the Merkel soil. Among the trees of limited extent are western redcedar, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 78. The highest average growth rate for Douglas fir is 77 cubic feet per acre per year at age 98. Based on a 50-year site curve, the mean site index for western larch is 72. The highest average growth rate for western larch is 105 cubic feet per acre per year at age 70. The typical basal area of trees on the Merkel soil is about 90 percent of that in normal stands of Douglas fir and western larch, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are the surface layer of sandy loam, the Rock outcrop, the stones, and the slope, which restricts the use of skidding equipment. When dry, the loose surface layer hinders the use of wheeled equipment. Using standard wheeled and tracked equipment causes the formation of ruts and displacement of the surface layer when the soil is dry. Cable yarding systems are safer on the steeper slopes. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes in the steeper areas requires extensive cutting and filling, which can remove land from production. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop and the stones on the surface can hinder harvesting. Also, falling timber can break on the Rock outcrop and the stones.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and ponderosa pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, western larch, or ponderosa pine seedlings. The limited available

water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed.

This unit is suited to grazing and browsing. The forest understory is mainly creambush oceanspray, common snowberry, pinegrass, ceanothus, kinnikinnick, pachystima, Oregongrape, huckleberry, elk sedge, spirea, mallow ninebark, and Saskatoon serviceberry. A uniform distribution of grazing by domestic livestock is unlikely because of the slope and the Rock outcrop. Overgrazing causes the desirable plants, such as creambush oceanspray, pinegrass, elk sedge, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope, the Rock outcrop, and the stones on the surface. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Merkel soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

77-Mobate-Rock outcrop complex, 0 to 40 percent slopes. This map unit is on the toe slopes and foot slopes of foothills and mountains. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 28 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 80 to 100 days.

This unit is about 65 percent Mobate gravelly loam, 0 to 40 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Mobate gravelly loam that has a slope of more than 40 percent and Moscow silt loam. Also included are Skanid loam and Usk stony loam on south- and west-facing slopes and very stony and very shallow soils near the Rock outcrop. Included areas make up about 15 percent of the unit.

This Mobate soil is shallow and well drained. It formed in residuum and colluvium derived dominantly from granitic rock. The residuum and colluvium have an admixture of volcanic ash and loess in the upper part. Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is grayish brown gravelly loam about 4 inches thick. The subsoil is pale brown gravelly loam about 6 inches thick. The substratum to a depth of 19 inches is very pale brown very gravelly sandy loam. Weathered granitic rock is at a depth of about 19 inches. The depth to weathered bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Mobate soil. Available water capacity is very low. The effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Rock outcrop consists mainly of exposed granitic rock.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir and ponderosa pine are the main woodland species on the Mobate soil. Among the trees of limited extent are grand fir, western redcedar, western larch, and lodgepole pine. Based on a 50-year site curve, the mean site index for Douglas fir is 76. The highest average growth rate for Douglas fir is 73 cubic feet per acre per year at age 99. Based on a 100-year site curve, the mean site index for ponderosa pine is 104. The highest average growth rate for ponderosa pine is 110 cubic feet per acre per year at age 40. The Rock outcrop is not productive. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the Rock outcrop, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep skid trails. firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir and ponderosa pine

occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. The very low available water capacity can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed. Because the rooting depth is restricted by the weathered bedrock, the trees are frequently subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, mallow ninebark, common snowberry, ceanothus, rose, bluebunch wheatgrass, creambush oceanspray, kinnikinnick, pachystima, Oregongrape, spirea, and strawberry. Overgrazing causes the desirable plants, such as pinegrass, bluebunch wheatgrass, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the Rock outcrop and the slope. Broadcasting is the most effective seeding method.

The Mobate soil is in capability subclass VIe. nonirrigated. The Rock outcrop is in capability subclass VIIIs.

78-Mobate-Rock outcrop complex, 40 to 65 percent slopes. This map unit is on the back slopes of foothills and mountains. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 28 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 80 to 100 days.

This unit is about 65 percent Mobate gravelly loam, 40 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Mobate gravelly loam that has a slope of less than 40 percent or more than 65 percent and Moscow silt loam. Also included are Skanid loam and Usk stony loam on south- and west-facing slopes and very stony and very shallow soils near the Rock outcrop. Included areas make up about 15 percent of the unit.

This Mobate soil is shallow and well drained. It formed in residuum and colluvium derived dominantly from granitic rock. The residuum and colluvium have an admixture of volcanic ash and loess in the upper part. Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is grayish brown gravelly loam about 4 inches thick. The subsoil is pale brown gravelly loam about 6 inches thick. The substratum to a depth of 19 inches is very pale brown very gravelly sandy loam. Weathered granitic rock is at a depth of about 19 inches. The depth to weathered bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Mobate soil. Available water capacity is very low. The effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed granitic rock.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir and ponderosa pine are the main woodland species on the Mobate soil. Among the trees of limited extent are grand fir, western redcedar, western larch, and lodgepole pine. Based on a 50-year site curve, the mean site index for Douglas fir is 76. The highest average growth rate for Douglas fir is 73 cubic feet per acre per year at age 99. Based on a 100-year site curve, the mean site index for ponderosa pine is 104. The highest average growth rate for ponderosa pine is 110 cubic feet per acre per year at age 40. The Rock outcrop is not productive. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are the Rock outcrop and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir and ponderosa pine occurs periodically. Reforestation can be accomplished

by planting Douglas fir, ponderosa pine, or western larch seedlings. The very low available water capacity can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed. Because the rooting depth is restricted by the weathered bedrock, the trees are frequently subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, mallow ninebark, common snowberry, ceanothus, rose, bluebunch wheatgrass, creambush oceanspray, kinnikinnick, pachystima, Oregongrape, spirea, and strawberry. A uniform distribution of grazing by domestic livestock is limited by the slope and the Rock outcrop. Overgrazing causes the desirable plants, such as pinegrass, bluebunch wheatgrass, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope and the Rock outcrop. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Mobate soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

79-Moscow silt loam, 0 to 25 percent slopes. This moderately deep, well drained soil is on the toe slopes and ridgetops of foothills and mountains. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from granitic rock. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,200 to 4,000 feet. The average annual precipitation is 27 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 80 to 100 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 1/4 inches thick. The surface layer is brown silt loam about 8 inches thick. The upper 4 inches of the subsoil is yellowish brown silt loam. The lower 15 inches is light yellowish brown gravelly sandy loam. Weathered granite is at a depth of about 27 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Moscow silt loam that has a slope of more than 25 percent and Mobate gravelly loam. Also included are Merkel stony sandy loam on toe slopes, Moso silt loam on toe slopes and in concave areas, Newbell silt loam on toe slopes, Usk loam on south- and west-facing ridgetops, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

Permeability is moderate in this Moscow soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 80. The highest average growth rate for Douglas fir is 81 cubic feet per acre per year at age 97. Based on a 50-year site curve, the mean site index for western larch is 71. The highest average growth rate for western larch is 103 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 100. The highest average growth rate for ponderosa pine is 102 cubic feet per acre per year at age 40. The typical basal area of trees is about 95 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, ponderosa pine. and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting

depth is restricted by the weathered bedrock. the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly Oregongrape, common snowberry, ceanothus, pinegrass, mallow ninebark, strawberry, Douglas maple, kinnikinnick, creambush oceanspray. Saskatoon serviceberry, pachystima, spirea, rose, and huckleberry. Overgrazing causes the desirable plants, such as pinegrass, mallow ninebark, Saskatoon serviceberry, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated barley and grass-legume hay. The main management concerns are the low available water capacity, the hazard of water erosion, and the slope. The crops that are tolerant. of drought grow best. The amount of available moisture is not adequate for most other crops to grow well. Minimizing tillage, seeding early in fall, chiseling in fall. and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions or terraces may be needed to control erosion on cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa. and 2 or 3 years of small grain.

The main limitations on homesites are the slope and the depth to bedrock. Special designs for buildings may be needed to overcome the slope. The cuts needed to provide essentially level building sites can expose the bedrock.

Septic tank absorption fields cannot function properly because of the slope in some areas and the depth to bedrock. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is Ille, nonirrigated.

80-Moscow silt loam, 25 to 40 percent slopes. This moderately deep, well drained soil is on the foot slopes and ridgetops of foothills and mountains. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from granitic rock. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,200 to 4,000 feet. The average annual precipitation is 27 to 30 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 80 to 100 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. The surface layer is brown silt loam about 8 inches thick. The upper 4 inches of the subsoil is yellowish brown silt loam. The lower 15 inches is light yellowish brown gravelly sandy loam. Weathered granite is at a depth of about 27 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Moscow silt loam that has a slope of less than 25 percent or more than 40 percent and Mobate gravelly loam. Also included are Merkel stony sandy loam on foot slopes, Moso silt loam on foot slopes and in concave areas, Newbell silt loam on foot slopes, Usk loam on south- and west-facing ridgetops, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

Permeability is moderate in this Moscow soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, homesite development, recreation, watershed and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 80. The highest average growth rate for Douglas fir is 81 cubic feet per acre per year at age 97. Based on a 50-year site curve, the mean site index for western larch is 71. The highest average growth rate for western larch is 103 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 100. The highest average growth rate for ponderosa pine is 102 cubic feet per acre per year at age 40. The typical basal area of trees is about 95 percent of that in normal stands of Douglas fir, western larch. and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most

readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

if the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, ponderosa pine, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the weathered bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly Oregongrape, common snowberry, ceanothus, pinegrass, mallow ninebark, strawberry, Douglas maple, kinnikinnick, creambush oceanspray, Saskatoon serviceberry, pachystima, spirea, rose, and huckleberry. Overgrazing causes the desirable plants, such as pinegrass, mallow ninebark. Saskatoon serviceberry, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting is the most effective seeding method.

The main limitations on homesites are the slope and the depth to bedrock. Special designs for buildings may be needed to overcome the slope. The cuts needed to provide essentially level building sites can expose the bedrock.

Septic tank absorption fields cannot function properly because of the depth to bedrock and the slope. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is VIe, nonirrigated.

81-Moscow silt loam, 40 to 65 percent slopes.

This moderately deep, well drained soil is on the back slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from granitic rock. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,200 to 4,000 feet. The average annual precipitation is 27 to 30 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 80 to 100 days.

Typically, the surface is covered with a mat of organic material about 1 1/4 inches thick. The surface layer is brown silt loam about 8 inches thick. The upper 4 inches of the subsoil is yellowish brown silt loam. The lower 15 inches is light yellowish brown gravelly sandy loam. Weathered granite is at a depth of about 27 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Moscow silt loam that has a slope of less than 40 percent or more than 65 percent, Merkel stony sandy loam, Mobate gravelly loam, and Newbell silt loam. Also included are Moso silt loam on the lower parts of the slopes and in concave areas, Usk loam on south- and west-facing slopes, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

Permeability is moderate in this Moscow soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 80. The highest average growth rate for Douglas fir is 81 cubic feet per acre per year at age 97. Based on a 50-year site curve, the mean site index for western larch is 71. The highest average growth rate for western larch is 103 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 100. The highest average growth rate for ponderosa pine is 102 cubic feet per acre per year at age 40. The typical basal area of trees is about 95 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment.

Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch. ponderosa pine, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the weathered bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly Oregongrape, common snowberry, ceanothus, pinegrass, mallow ninebark, strawberry, Douglas maple, kinnikinnick, creambush oceanspray, Saskatoon serviceberry, pachystima, spirea, rose. and huckleberry. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Overgrazing causes the desirable plants, such as pinegrass, mallow ninebark, Saskatoon serviceberry, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIe, nonirrigated.

82-Moscow-Rock outcrop complex, 0 to 40 percent slopes. This map unit is on the toe slopes, foot slopes, and ridgetops of foothills and mountains. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,200 to 4,000 feet. The average annual precipitation is 27 to 30 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 80 to 100 days.

This unit is about 65 percent Moscow silt loam, 0 to 40 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Moscow silt loam that has a slope of more than 40 percent and Mobate gravelly loam. Also included are Merkel stony sandy loam on toe slopes and foot slopes; Moso silt loam on toe slopes, on foot slopes, and in concave areas; Newbell silt loam on toe slopes and foot slopes; and Usk stony loam on south- and west-facing ridgetops; poorly drained soils in draws and adjacent to seeps and springs; and very stony and very shallow soils near the Rock outcrop. Included areas make up about 15 percent of the unit.

This Moscow soil is moderately deep and well drained. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from granitic rock. Typically, the surface is covered with a mat of organic material about 1 1/4 inches thick. The surface layer is brown silt loam about 8 inches thick. The upper 4 inches of the subsoil is yellowish brown silt loam. The lower 15 inches is light yellowish brown gravelly sandy loam. Weathered granite is at a depth of about 27 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Moscow soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

The Rock outcrop consists mainly of exposed granitic rock.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on the Moscow soil. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 80. The highest average growth rate for Douglas fir is 81 cubic feet per acre per year at age 97. Based on a 50-year site curve, the mean site index for western larch is 71. The highest average growth rate for western larch is 103 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 100. The highest average growth rate for ponderosa pine is 102 cubic feet per acre per year at age 40. The typical basal area of trees on the Moscow soil is about 95 percent of that in normal stands of Douglas fir, western

larch, and ponderosa pine, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the Rock outcrop, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, ponderosa pine, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed. Because the rooting depth is restricted by the weathered bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly Oregongrape, common snowberry, ceanothus, pinegrass, mallow ninebark, strawberry, Douglas maple, kinnikinnick, creambush oceanspray, Saskatoon serviceberry, pachystima, spirea, rose, and huckleberry. Overgrazing causes the desirable plants, such as pinegrass, mallow ninebark, Saskatoon serviceberry, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the Rock outcrop and the slope. Broadcasting is the most effective seeding method.

The Moscow soil is in capability subclass Vle, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

83-Moscow-Rock outcrop complex, 40 to 65 percent slopes. This map unit is on the back slopes of foothills and mountains. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,200 to 4,000 feet. The average annual precipitation is 27 to 30 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 80 to 100 days.

This unit is about 65 percent Moscow silt loam, 40 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Moscow silt loam that has a slope of less than 40 percent or more than 65 percent, Merkel stony sandy loam, Mobate gravelly loam, and Newbell silt loam. Also included are Moso silt loam on the lower parts of the slopes and in concave areas, Usk stony loam on south- and west-facing slopes. poorly drained soils in draws and adjacent to seeps and springs, and very stony and very shallow soils near the Rock outcrop. Included areas make up about 15 percent of the unit.

This Moscow soil is moderately deep and well drained. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from granitic rock. Typically, the surface is covered with a mat of organic material about 1 1/4 inches thick. The surface layer is brown silt loam about 8 inches thick. The upper 4 inches of the subsoil is yellowish brown silt loam. The lower 15 inches is light yellowish brown gravelly sandy loam. Weathered granite is at a depth of about 27 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Moscow soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed granitic rock.

This unit is used for grazable woodland. recreation. watershed, and wildlife habitat.

Douglas fir. western larch, ponderosa pine, and western redcedar are the main woodland species on the

Moscow soil. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 80. The highest average growth rate for Douglas fir is 81 cubic feet per acre per year at age 97. Based on a 50-year site curve, the mean site index for western larch is 71. The highest average growth rate for western larch is 103 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 100. The highest average growth rate for ponderosa pine is 102 cubic feet per acre per year at age 40. The typical basal area of trees on the Moscow soil is about 95 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are the Rock outcrop and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, ponderosa pine, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed. Because the rooting depth is restricted by the weathered bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly Oregongrape, common snowberry, ceanothus, pinegrass, mallow ninebark, strawberry, Douglas maple, kinnikinnick, creambush oceanspray, Saskatoon serviceberry, pachystima. spirea, rose, and huckleberry. A uniform distribution of grazing by domestic livestock is unlikely because of the slope and the Rock outcrop. Overgrazing causes the desirable plants, such as pinegrass, mallow ninebark, Saskatoon serviceberry, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope and the Rock outcrop. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Moscow soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

84-Moso silt loam, 0 to 25 percent slopes. This deep, well drained soil is on the toe slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from granitic rock, schist, and gneiss. Slopes are concave or convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 25 to 38 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. The surface layer is grayish brown silt loam about 2 inches thick. The upper 6 inches of the subsoil is pale brown silt loam. The next 4 inches is light yellowish brown loam. The lower 23 inches is pale brown gravelly sandy loam. The substratum is light brownish gray very gravelly loamy coarse sand about 13 inches thick. Weathered granitic rock is at a depth of about 48 inches. The depth to weathered bedrock ranges from 40 to 60 inches.

Included in this unit are small areas of Moso silt loam that has a slope of more than 25 percent, Moscow silt loam, Newbell silt loam, and Scrabblers silt loam. Also included are Usk loam on south- and west-facing slopes, Rock outcrop on knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Moso soil. Available water capacity also is moderate. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 88. The highest average growth rate for Douglas fir is 99 cubic feet per acre per year at age 91. Based on a 100-year site curve, the mean site index for ponderosa pine is 125. The highest average growth rate for ponderosa pine is 154 cubic feet per acre per year at age 40. Estimates of the site index and growth rate for western larch and western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, ponderosa pine, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, creambush oceanspray, common snowberry, Oregongrape, ceanothus, pachystima, rose, kinnikinnick, longtube twinflower, huckleberry, spirea, and Douglas maple. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, and huckleberry, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated barley and grass-legume hay. The main management concerns are the hazard of water erosion and the slope. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions or terraces may be needed to control erosion on cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

The main limitations on homesites are the slope, the instability of cutbanks, and the depth to bedrock. Special designs for buildings may be needed to overcome the slope. The sides of shallow excavations can cave in unless they are supported by special retainer walls. The cuts needed to provide essentially level building sites can expose the bedrock.

Septic tank absorption fields cannot function properly because of the depth to bedrock and the slope in some areas. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is IIIe, nonirrigated.

85-Moso silt loam, 25 to 40 percent slopes. This deep, well drained soil is on the foot slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from granitic rock, schist, and gneiss. Slopes are concave or convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 25 to 38 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. The surface layer is grayish brown silt loam about 2 inches thick. The upper 6 inches of the subsoil is pale brown silt loam. The next 4 inches is light yellowish brown loam. The lower 23 inches is pale brown gravelly sandy loam. The substratum is light brownish gray very gravelly loamy coarse sand about 13 inches thick. Weathered granitic rock is at a depth of about 48 inches. The depth to weathered bedrock ranges from 40 to 60 inches.

Included in this unit are small areas of Moso silt loam that has a slope of less than 25 percent or more than 40 percent, Moscow silt loam, Newbell silt loam, and Scrabblers silt loam. Also included are Usk loam on south- and west-facing slopes, Rock outcrop on knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Moso soil. Available

water capacity also is moderate. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 88. The highest average growth rate for Douglas fir is 99 cubic feet per acre per year at age 91. Based on a 100-year site curve, the mean site index for ponderosa pine is 125. The highest average growth rate for ponderosa pine is 154 cubic feet per acre per year at age 40. Estimates of the site index and growth rate for western larch and western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, ponderosa pine, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, creambush oceanspray, common snowberry, Oregongrape, ceanothus, kinnikinnick, longtube twinflower, huckleberry, spirea, Douglas maple, pachystima, and rose. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, and huckleberry, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting is the most effective seeding method.

The main limitations on homesites are the slope, the depth to bedrock, and the instability of cutbanks. Special designs for buildings may be needed to overcome the slope. The sides of shallow excavations can cave in unless they are supported by special retainer walls. The cuts needed to provide essentially level building sites can expose the bedrock.

Septic tank absorption fields cannot function properly because of the slope and the depth to bedrock. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is VIe, nonirrigated.

86-Newbell silt loam, 0 to 25 percent slopes. This very deep, well drained soil is on the toe slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 120 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is yellowish brown silt loam about 6 inches thick. The subsoil is light yellowish brown silt loam about 6 inches thick. The upper 6 inches of the substratum is very pale brown very gravelly sandy loam. The lower part to a depth of 60 inches or more is light gray very gravelly sandy loam. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Included in this unit are small areas of Newbell silt loam that has a slope of more than 25 percent, Aits loam, and Scrabblers silt loam. Also included are Inkler gravelly silt loam on south- and west-facing slopes, Moscow silt loam on the upper parts of the slopes, Rock outcrop on knobs, and poorly drained soils in draws and adjacent to springs and seeps. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Newbell soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated

crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 82. The highest average growth rate for Douglas fir is 86 cubic feet per acre per year at age 96. Based on a 50-year site curve, the mean site index for western larch is 85. The highest average growth rate for western larch is 132 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 103. The highest average growth rate for ponderosa pine is 108 cubic feet per acre per year at age 40. The typical basal area of trees is about 95 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index or growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, ceanothus, common snowberry, mallow ninebark, creambush oceanspray, huckleberry, elk sedge, strawberry, Oregongrape, kinnikinnick, and pachystima. Overgrazing causes the desirable plants, such as pinegrass, elk sedge, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated wheat, barley, and grass-legume hay. The main management concerns are the hazard of water erosion and the slope. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions or terraces may be needed to control erosion on cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

The main limitation on homesites is the slope. Special designs for buildings may be needed to overcome the slope.

The main limitation on sites for septic tank absorption fields is the slope. Where the slope is less than 15 percent, the absorption fields can function properly if the absorption lines are installed on the contour as needed. The absorption fields cannot function properly on the steeper slopes. As a result, the effluent can surface in downslope areas and create a health hazard.

The capability subclass is IIIe, nonirrigated.

87-Newbell silt loam, 25 to 40 percent slopes. This very deep, well drained soil is on the foot slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are convex or concave and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is yellowish brown silt loam about 6 inches thick. The subsoil is light yellowish brown silt loam about 6 inches thick. The upper 6 inches of the substratum is very pale brown very gravelly sandy loam. The lower part to a depth of 60 inches or more is light gray very gravelly sandy loam. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Included in this unit are small areas of Newbell silt loam that has a slope of less than 25 percent or more than 40 percent, Aits loam. and Scrabblers silt loam. Also included are Inkler gravelly silt loam on south- and west-facing slopes, Moscow silt loam on the upper parts of the slopes, Rock outcrop on knobs, and poorly

drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Newbell soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 82. The highest average growth rate for Douglas fir is 86 cubic feet per acre per year at age 96. Based on a 50-year site curve, the mean site index for western larch is 85. The highest average growth rate for western larch is 132 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 103. The highest average growth rate for ponderosa pine is 108 cubic feet per acre per year at age 40. The typical basal area of trees is about 95 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, ceanothus, common snowberry, mallow ninebark, creambush oceanspray, huckleberry, elk sedge, strawberry, Oregongrape, kinnikinnick, and pachystima. Overgrazing causes the desirable plants, such as pinegrass, elk sedge, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting is the most effective seeding method.

The main limitation on homesites is the slope. Special designs for buildings may be needed to overcome the slope.

Septic tank absorption fields cannot function properly because of the slope. The effluent from the absorption fields can surface in downslope areas and create a health hazard.

The capability subclass is VIe, nonirrigated.

88-Newbell silt loam, 40 to 65 percent slopes. This very deep, well drained soil is on the back slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are convex or concave and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is yellowish brown silt loam about 6 inches thick. The subsoil is light yellowish brown silt loam about 6 inches thick. The upper 6 inches of the substratum is very pale brown very gravelly sandy loam. The lower part to a depth of 60 inches or more is light gray very gravelly sandy loam. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Included in this unit are small areas of Newbell silt loam that has a slope of less than 40 percent or more than 65 percent, Aits loam, and Scrabblers silt loam. Also included are Inkler gravelly silt loam on south- and west-facing slopes, Moscow silt loam on the upper parts of the slopes, Rock outcrop on knobs and ridges, and poorly drained soils in draws and adjacent to seeps and

springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Newbell soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 82. The highest average growth rate for Douglas fir is 86 cubic feet per acre per year at age 96. Based on a 50-year site curve, the mean site index for western larch is 85. The highest average growth rate for western larch is 132 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 103. The highest average growth rate for ponderosa pine is 108 cubic feet per acre per year at age 40. The typical basal area of trees is about 95 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, ceanothus, common snowberry, mallow ninebark, creambush oceanspray, huckleberry, elk sedge, strawberry, Oregongrape, kinnikinnick, and pachystima. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Overgrazing causes the desirable plants, such as pinegrass, elk sedge, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIe, nonirrigated.

89-Newbell stony silt loam, 0 to 40 percent slopes. This very deep, well drained soil is on the toe slopes and foot slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is yellowish brown stony silt loam about 6 inches thick. The subsoil is light yellowish brown stony silt loam about 6 inches thick. The upper 6 inches of the substratum is very pale brown very gravelly sandy loam. The lower part to a depth of 60 inches or more is light gray very gravelly sandy loam. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Included in this unit are small areas of Newbell stony loam that has a slope of more than 40 percent, Aits stony loam, Merkel stony sandy loam, and Scrabblers silt loam. Also included are Inkler gravelly silt loam on south- and west-facing foot slopes, Rock outcrop on knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Newbell soil. Available water capacity is low or moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western

hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 82. The highest average growth rate for Douglas fir is 86 cubic feet per acre per year at age 96. Based on a 50-year site curve, the mean site index for western larch is 85. The highest average growth rate for western larch is 132 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 103. The highest average growth rate for ponderosa pine is 108 cubic feet per acre per year at age 40. The typical basal area of trees is about 95 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the stones, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The stones on the surface can hinder harvesting. Also, falling timber can break on the stones.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, ceanothus, common snowberry, mallow ninebark, creambush oceanspray, huckleberry, elk sedge, strawberry, Oregongrape, kinnikinnick, and pachystima. Overgrazing causes the desirable plants, such as pinegrass, elk sedge, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the stones on the surface and by the slope. Broadcasting is the most effective seeding method.

The main limitations on homesites are the slope and large stones. Special designs for buildings may be needed to overcome the slope. The large stones can interfere with excavation.

The main limitations on sites for septic tank absorption fields are the slope and the large stones. Where the slope is less than 15 percent, the absorption fields can function properly if the absorption lines are installed on the contour as needed. The absorption fields cannot function properly on the steeper slopes. As a result, the effluent can surface in downslope areas and create a health hazard. The large stones can interfere with the installation of the absorption lines.

The capability subclass is VIs, nonirrigated.

90-Newbell stony silt loam, 40 to 65 percent slopes. This very deep, well drained soil is on the back slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is yellowish brown stony silt loam about 6 inches thick. The subsoil is light yellowish brown stony silt loam about 6 inches thick. The upper 6 inches of the substratum is very pale brown very gravelly sandy loam. The lower part to a depth of 60 inches or more is light gray very gravelly sandy loam. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Included in this unit are small areas of Newbell stony loam that has a slope of less than 40 percent or more than 65 percent, Aits stony loam, and Scrabblers silt loam. Also included are Inkler gravelly silt loam on south- and west-facing slopes, Merkel stony sandy loam on the lower parts of the slopes, Moscow silt loam on the upper parts of the slopes, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Newbell soil.

Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 82. The highest average growth rate for Douglas fir is 86 cubic feet per acre per year at age 96. Based on a 50-year site curve, the mean site index for western larch is 85. The highest average growth rate for western larch is 132 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 103. The highest average growth rate for ponderosa pine is 108 cubic feet per acre per year at age 40. The typical basal area of trees is about 95 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are the stones and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The stones on the surface can hinder harvesting. Also, falling timber can break on the stones.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, ponderosa pine, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir, western larch, or ponderosa pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, ceanothus, common snowberry, mallow ninebark, creambush oceanspray, huckleberry, elk sedge, strawberry, Oregongrape, kinnikinnick, and pachystima. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Overgrazing causes the desirable plants, such as pinegrass, elk sedge, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope and by the stones on the surface. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIs, nonirrigated.

91-Newbell very bouldery silt loam, 25 to 40 percent slopes. This very deep, well drained soil is on the foot slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is yellowish brown very bouldery silt loam about 6 inches thick. The subsoil is light yellowish brown very bouldery silt loam about 6 inches thick. The upper 6 inches of the substratum is very pale brown very gravelly sandy loam. The lower part to a depth of 60 inches or more is light gray very gravelly sandy loam. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Included in this unit are small areas of Newbell very bouldery silt loam that has a slope of less than 25 percent or more than 40 percent, Aits stony loam, Moscow silt loam, and Scrabblers silt loam. Also included are Inkler gravelly silt loam on south- and west-facing slopes, Merkel stony sandy loam on the lower parts of the slopes. Rock outcrop on knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Newbell soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 82. The highest average growth rate for Douglas fir is 86 cubic feet per acre per year at age 96. Based on a 50-year site curve, the mean site index for western larch is 85. The highest average growth rate for western larch is 132 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 103. The highest average growth rate for ponderosa pine is 108 cubic feet per acre per year at age 40. The typical basal area of trees is about 95 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are the boulders, soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The boulders on the surface can hinder harvesting. Also, falling timber can break on the boulders.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. The boulders on the surface limit the even distribution of reforestation.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, ceanothus, common snowberry, mallow ninebark, creambush oceanspray, huckleberry, elk sedge, strawberry, Oregongrape, kinnikinnick, and pachystima. Overgrazing causes the desirable plants, such as pinegrass, elk sedge, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the boulders on the surface and by the slope. Broadcasting is the most effective seeding method.

The capability subclass is VIs, nonirrigated.

92-Newbell very bouldery silt loam, 40 to 65 percent slopes. This very deep, well drained soil is on the back slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is yellowish brown very bouldery silt loam about 6 inches thick. The subsoil is light yellowish brown very bouldery silt loam about 6 inches thick. The upper 6 inches of the substratum is very pale brown very gravelly sandy loam. The lower part to a depth of 60 inches or more is light gray very gravelly sandy loam. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Included in this unit are small areas of Newbell very bouldery silt loam that has a slope of less than 40 percent or more than 65 percent, Aits stony loam, and Scrabblers silt loam. Also included are Inkler gravelly silt loam on south- and west-facing slopes, Merkel stony sandy loam on the lower parts of the slopes, Moscow silt loam on the upper parts of the slopes, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Newbell soil. Available water capacity is low or moderate. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on

this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 82. The highest average growth rate for Douglas fir is 86 cubic feet per acre per year at age 96. Based on a 50-year site curve, the mean site index for western larch is 85. The highest average growth rate for western larch is 132 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 103. The highest average growth rate for ponderosa pine is 108 cubic feet per acre per year at age 40. The typical basal area of trees is about 95 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are the boulders and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The boulders on the surface can hinder harvesting. Also, falling timber can break on the boulders.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. The boulders on the surface limit the even distribution of reforestation.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, ceanothus, common snowberry, mallow ninebark, creambush oceanspray, huckleberry, elk sedge, strawberry, Oregongrape, kinnikinnick, and pachystima. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Overgrazing causes the desirable plants, such as pinegrass, elk sedge, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope and the boulders on the surface. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIs, nonirrigated.

93-Newbell-Rock outcrop complex, 15 to 40 percent slopes. This map unit is on the toe slopes and foot slopes of foothills and mountains. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

This unit is about 65 percent Newbell stony silt loam, 15 to 40 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Newbell stony silt loam that has a slope of less than 15 percent or more than 40 percent, Aits stony loam, Moscow silt loam, and Scrabblers silt loam. Also included are Inkler gravelly silt loam on south- and west-facing slopes, Merkel stony sandy loam on the lower parts of the slopes, very stony and very shallow soils near the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

This Newbell soil is very deep and well drained. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is yellowish brown stony silt loam about 6 inches thick. The subsoil is light yellowish brown stony silt loam about 6 inches thick. The upper 6 inches of the substratum is very pale brown very gravelly sandy loam. The lower part to a depth of 60 inches or more is light gray *very* gravelly sandy loam. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Permeability is moderate in the Newbell soil. Available water capacity is low or moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

The Rock outcrop consists mainly of exposed granitic rock.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on the Newbell soil. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 82. The highest average growth rate for Douglas fir is 86 cubic feet per acre per year at age 96. Based on a 50-year site curve, the mean site index for western larch is 85. The highest average growth rate for western larch is 132 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 103. The highest average growth rate for ponderosa pine is 108 cubic feet per acre per year at age 40. The typical basal area of trees on the Newbell soil is about 95 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the Rock outcrop, the stones, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop and the stones on the surface can hinder harvesting. Also, falling timber can break on the Rock outcrop and the stones.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, ceanothus, common snowberry, mallow ninebark, creambush oceanspray, huckleberry, elk sedge, strawberry, Oregongrape, kinnikinnick, and pachystima. Overgrazing causes the desirable plants, such as pinegrass, elk sedge, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the Rock outcrop, the stones on the surface, and the slope. Broadcasting is the most effective seeding method.

The Newbell soil is in capability subclass VIs, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

94-Newbell-Rock outcrop complex, 40 to 65 percent slopes. This map unit is on the back slopes of foothills and mountains. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

This unit is about 65 percent Newbell stony silt loam, 40 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Newbell stony silt loam that has a slope of less than 40 percent or more than 65 percent, Aits stony loam, Moscow silt loam, and Scrabblers silt loam. Also included are Inkler gravelly silt loam on south- and west-facing slopes, Merkel stony sandy loam on the lower parts of the slopes, very stony and very shallow soils near the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

This Newbell soil is very deep and well drained. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is yellowish brown stony silt loam about 6 inches thick. The subsoil is light yellowish brown stony silt loam about 6 inches thick. The upper 6 inches of the substratum is very pale brown very gravelly sandy loam. The lower part to a depth of 60

inches or more is light gray very gravelly sandy loam. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Permeability is moderate in the Newbell soil. Available water capacity is low or moderate. The. effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed granitic rock.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on the Newbell soil. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 82. The highest average growth rate for Douglas fir is 86 cubic feet per acre per year at age 96. Based on a 50-year site curve, the mean site index for western larch is 85. The highest average growth rate for western larch is 132 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 103. The highest average growth rate for ponderosa pine is 108 cubic feet per acre per year at age 40. The typical basal area of trees on the Newbell soil is about 95 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are the Rock outcrop, the stones, and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop and the stones on the surface can hinder harvesting. Also, falling timber can break on the Rock outcrop and the stones.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, ceanothus, common snowberry, mallow ninebark, creambush oceanspray, huckleberry, elk sedge, strawberry, Oregongrape, kinnikinnick, and pachystima. A uniform distribution of grazing by domestic livestock is unlikely because of the slope and the Rock outcrop. Overgrazing causes the desirable plants, such as pinegrass, elk sedge, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope, the Rock outcrop, and the stones on the surface. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Newbell soil is in capability subclass VIIs, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

95-Ojibway gravelly loam, 40 to 65 percent slopes. This moderately deep, well drained soil is on the back slopes of foothills and mountains. It formed in colluvium and residuum derived dominantly from amphibolite. The residuum and colluvium have an admixture of volcanic ash and loess. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,600 to 4,750 feet. The average annual precipitation is 30 to 45 inches, the average annual air temperature is about 43 degrees F, and the average growing season (at 28 degrees) is 90 to 100 days.

Typically, the surface is covered with a mat of organic material about 2 inches thick. When mixed to a depth of about 5 inches, the surface layer is dark brown gravelly loam. The upper part of the subsoil is dark brown very gravelly loam about 6 inches thick. The next part is strong brown gravelly loam about 6 inches thick. The lower part is strong brown gravelly sandy loam about 6 inches thick. Weathered amphibolite is at a depth of about 23 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Ojibway

gravelly loam that has a slope of less than 40 percent or more than 65 percent, Hartill silt loam at the higher elevations, and Raisio channery loam and Rufus channery loam at the lower elevations. Also included are Rock outcrop on knobs and ridges and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Ojibway soil. Available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is *very* rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, ponderosa pine, and western larch are the main woodland species on this unit. Among the trees of limited extent are lodgepole pine and grand fir. Based on a 50-year site curve, the mean site index for Douglas fir is 75. The highest average growth rate for Douglas fir is 71 cubic feet per acre per year at age 100. Estimates of the site index and growth rate for ponderosa pine and western larch have not been made.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, and western larch occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural or planted reforestation species. Because the rooting depth is restricted by the weathered bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly common snowberry, pinegrass, mallow ninebark, willow, creambush oceanspray, elk sedge, thimbleberry, rose, strawberry, spirea, pachystima, Oregongrape, Saskatoon serviceberry, and starry false Solomons seal. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Overgrazing causes the desirable plants, such as pinegrass, elk sedge, mallow ninebark, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIe, nonirrigated.

96-Ojibway-Rock outcrop complex, 30 to 65 percent slopes. This map unit is on the foot slopes and back slopes of foothills and mountains. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,600 to 4,750 feet. The average annual precipitation is 30 to 45 inches, the average annual air temperature is about 43 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

This unit is about 65 percent Ojibway gravelly loam, 30 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Ojibway gravelly loam that has a slope of less than 30 percent or more than 65 percent, Hartill silt loam at the higher elevations, and Raisio channery loam and Rufus channery loam at the lower elevations. Also included are very stony and very shallow soils near the Rock outcrop and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

This Ojibway soil is moderately deep and well drained. It formed in colluvium and residuum derived dominantly from amphibolite. The residuum and colluvium have an admixture of volcanic ash and loess. Typically, the surface is covered with a mat of organic material about 2 inches thick. When mixed to a depth of about 5 inches, the surface layer is dark brown gravelly loam. The upper part of the subsoil also is dark brown very gravelly loam. It is about 6 inches thick. The next part is strong brown gravelly loam about 6 inches thick. The lower part is strong brown gravelly sandy loam about 6 inches thick. Weathered amphibolite is at a depth of about 23 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Ojibway soil.

Available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed amphibolite.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, ponderosa pine, and western larch are the main woodland species on the Ojibway soil. Among the trees of limited extent are lodgepole pine and grand fir. Based on a 50-year site curve, the mean site index for Douglas fir is 75. The highest average growth rate for Douglas fir is 71 cubic feet per acre per year at age 100. The Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for ponderosa pine and western larch have not been made.

The main limitations affecting timber harvesting are the Rock outcrop and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, ponderosa pine, and western larch occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings. The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural or planted reforestation species. Because the rooting depth is restricted by the weathered bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly common snowberry, pinegrass, mallow ninebark, willow, creambush oceanspray, elk sedge, thimbleberry, rose, strawberry, spirea, pachystima, Oregongrape, Saskatoon serviceberry, and starry false Solomons seal. A uniform distribution of grazing by domestic livestock is unlikely because of the slope and the Rock outcrop. Overgrazing causes the desirable plants, such as pinegrass, elk sedge, mallow ninebark, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope and the Rock outcrop. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Ojibway soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

97-Orwig sandy loam, 0 to 20 percent slopes. This very deep, well drained soil is on terraces. It formed in sandy glacial outwash derived dominantly from granitic rock. The outwash has an admixture of volcanic ash and loess in the upper part. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 2 inches thick. When mixed to a depth of about 4 inches, the surface layer is light yellowish brown sandy loam. The upper 5 inches of the subsoil also is light yellowish brown sandy loam. The lower 9 inches is very pale brown sandy loam. The upper 9 inches of the substratum is very pale brown loamy sand. The lower part to a depth of 60 inches or more is very pale brown gravelly sand.

Included in this unit are small areas of Orwig sandy loam that has a slope of more than 20 percent, Bonner silt loam, Bonner gravelly silt loam, Kaniksu sandy loam, Kiehl gravelly silt loam, and Scrabblers silt loam. Also included are Kegel loam in draws and Rathdrum very fine sandy loam in depressions. Included areas make up about 15 percent of the unit.

Permeability is moderately rapid to a depth of 18 inches in this Orwig soil and rapid below that depth. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated and irrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Ponderosa pine, Douglas fir, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent is grand fir. Based on a 100-year site curve, the mean site index for ponderosa pine is 105. The highest average growth rate for ponderosa pine is 112 cubic feet per acre per year at age 40. Based on a 50-year site curve, the mean site index for Douglas fir is 77. The highest average growth rate for Douglas fir is 75 cubic feet per acre per year at age 99. The typical basal area of trees is about 75 percent of that in normal stands of ponderosa pine and Douglas fir. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for lodgepole pine have not been made.

The main limitations affecting timber harvesting are the surface layer of sandy loam and snowpack in winter. Using standard wheeled and tracked equipment causes the formation of ruts and displacement of the surface layer when the soil is dry. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine, Douglas fir, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. The low available water capacity can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly Saskatoon serviceberry, pinegrass, creambush oceanspray, common snowberry, kinnikinnick, Oregongrape, spirea, elk sedge, strawberry, huckleberry, pachystima, rose, mallow ninebark, and ceanothus. Overgrazing causes the desirable plants, such as pinegrass, elk sedge, mallow ninebark, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated and irrigated barley and grass-legume hay. The main management concerns are the low available water capacity, the hazard of water erosion, and the slope. The crops that are tolerant of drought grow best. The amount of available moisture is not adequate for most other crops to grow well. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Stripcropping and diversions or terraces may be needed to control water erosion on non irrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

The main limitations on homesites are the slope and the instability of cutbanks. Special designs for buildings may be needed to overcome the slope. The sides of shallow excavations can cave in unless they are supported by special retainer walls.

The main limitations on sites for septic tank absorption fields are the slope and the rapid permeability in the substratum. Where the slope is less than 15 percent, the absorption fields can function properly if the absorption lines are installed on the contour as needed. The absorption fields cannot function properly on the steeper slopes. As a result, the effluent from the absorption fields can surface in downslope areas and create a health hazard. Seepage can contaminate ground water because of the rapid permeability.

The capability subclasses are IVe, irrigated, and IIIe, nonirrigated.

98-Orwig sandy loam, 20 to 65 percent slopes. This very deep, well drained soil is on terrace escarpments. It formed in sandy glacial outwash derived dominantly from granitic rock. The outwash has an admixture of volcanic ash and loess in the upper part. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 2 inches thick. When mixed to a depth of about 4 inches, the surface layer is light yellowish brown sandy loam. The upper 5 inches of the subsoil also is light yellowish brown sandy loam. The lower 9 inches is very pale brown sandy loam. The upper 9 inches of the substratum is very pale brown loamy sand. The lower part to a depth of 60 inches or more is very pale brown gravelly sand.

Included in this unit are small areas of Orwig sandy

loam that has a slope of less than 20 percent or more than 65 percent, Kaniksu sandy loam, Kiehl gravelly silt loam, and Typic Xerorthents. Included areas make up about 15 percent of the unit.

Permeability is moderately rapid to a depth of 18 inches in this Orwig soil and rapid below that depth. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Ponderosa pine, Douglas fir, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent is grand fir. Based on a 100-year site curve, the mean site index for ponderosa pine is 105. The highest average growth rate for ponderosa pine is 112 cubic feet per acre per year at age 40. Based on a 50-year site curve, the mean site index for Douglas fir is 77. The highest average growth rate for Douglas fir is 75 cubic feet per acre per year at age 99. The typical basal area of trees is about 75 percent of that in normal stands of ponderosa pine and Douglas fir. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for lodgepole pine have not been made.

The main limitations affecting timber harvesting are the surface layer of sandy loam, snowpack in winter, and the slope, which restricts the use of skidding equipment. When dry, the loose surface layer hinders the use of wheeled equipment. Using standard wheeled and tracked equipment causes the formation of ruts and displacement of the surface layer when the soil is dry. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. Cable yarding systems are safer on the steeper slopes. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. Occasional snowpack hinders the use of equipment in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine, Douglas fir, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. The low available water capacity can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly Saskatoon serviceberry, creambush oceanspray, common snowberry, kinnikinnick, Oregongrape, spirea, elk sedge, strawberry, huckleberry, pachystima, rose, mallow ninebark, and ceanothus. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Overgrazing causes the desirable plants, such as pinegrass, elk sedge, mallow ninebark, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIe, nonirrigated.

99-Pits. This map unit consists of open excavations from which soil material and some of the underlying bedrock have been removed. The kinds of pits in the survey area are clay, sand, and gravel pits; mine pits; and quarries. The clay, sand, and gravel pits are mainly on terraces, and the mine pits and quarries are mainly in areas where bedrock is at or near the surface.

Included in this unit are small areas of soils and Rock outcrop that have not been excavated. Also included are small ponds in areas where material has been excavated below the water table.

Permeability and available water capacity vary widely in this unit. Runoff is ponded to very rapid.

This unit is used mainly for wildlife habitat and as a source of clay, sand, and gravel.

No capability classification has been assigned.

100-Prouty-Rock outcrop complex, 30 to 65 percent slopes. This map unit is on the foot slopes of mountains. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 45 to 55 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 70 to 90 days.

This unit is about 65 percent Prouty extremely bouldery silt loam, 30 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Prouty extremely bouldery silt loam that has a slope of less than 30 percent or more than 65 percent, Buhrig very

stony loam, Manley bouldery silt loam, and Vassar silt loam. Also included are very stony and very shallow soils near the Rock outcrop and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

This Prouty soil is moderately deep and well drained. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from granitic rock. Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is yellowish brown extremely bouldery silt loam about 7 inches thick. The upper 6 inches of the subsoil is light yellowish brown gravelly silt loam. The lower 4 inches is very pale brown gravelly sandy loam. The substratum is very pale brown very gravelly sandy loam about 11 inches thick. Weathered granite is at a depth of about 28 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Prouty soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed granitic rock.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on the Prouty soil. Among the trees of limited extent are western hemlock, western larch, grand fir, lodgepole pine, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for subalpine fir is 85. The highest average growth rate for subalpine fir is 84 cubic feet per acre per year at age 95. Based on a 50-year site curve, the mean site index for Engelmann spruce is 95. The highest average growth rate for Engelmann spruce is 100 cubic feet per acre per year at age 90. The Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for Douglas fir have not been made. The forest understory is mainly huckleberry, common beargrass, common snowberry, pachystima, ceanothus, pinegrass, rose, longtube twinflower, common princes pine, creambush oceanspray, and queencup beadlily.

The main limitations affecting timber harvesting are the Rock outcrop. the boulders. and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter. The Rock outcrop and the boulders can hinder harvesting. Also, falling timber can break on the Rock outcrop and the boulders.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of the boulders and large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. The Rock outcrop limits the distribution of reforestation. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

The Prouty soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

101-Prouty Variant silt loam, 30 to 65 percent slopes. This moderately deep, well drained soil is on the back slopes and ridgetops of mountains. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from limestone. Slopes are convex. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 4,400 to 5,500 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is about 38 degrees F, and the average growing season (at 28 degrees) is 60 to 90 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 10 inches, the surface layer is strong brown silt loam. The subsoil is yellowish brown gravelly silt loam about 3 inches thick. The substratum is light olive brown extremely gravelly sandy loam about 17 inches thick. Limestone is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Prouty Variant silt loam that has a slope of less than 30 percent or more than 65 percent. Conto silt loam. Conto Variant sandy loam and Huckleberry silt loam. Also included is Rock outcrop on ridges and knobs. Included areas

make up about 20 percent of the unit.

Permeability is moderate in this Prouty Variant soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on this unit. Among the trees of limited extent are western hemlock, western larch, grand fir, lodgepole pine, western redcedar, and western white pine. Based on a 50-year site curve. the mean site index for Douglas fir is 59. The highest average growth rate for Douglas fir is 42 cubic feet per acre per year at age 111. Based on a 50-year site curve, the mean site index for western larch is 64. The highest average growth rate for western larch is 55 cubic feet per acre per year at age 115. Based on a 100-year site curve, the mean site index for lodgepole pine is 87. The highest average growth rate for lodgepole pine is 102 cubic feet per acre per year at age 100. The typical basal area of trees is about 55 percent of that in a normal stand of Douglas fir. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for subalpine fir and Engelmann spruce have not been made. The forest understory is mainly pachystima, common beargrass, ceanothus, common snowberry, pinegrass, huckleberry, strawberry, Saskatoon serviceberry, green fescue, rusty menziesia, common princes pine, longtube twinflower, and elk sedge.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce. western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

The capability subclass is VIIe, nonirrigated.

102-Prouty Variant-Rock outcrop complex, 5 to 40 percent slopes. This map unit is on the foot slopes and ridgetops of mountains. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 4,400 to 5,500 feet. The average annual precipitation is 40 to 50 inches. the average annual air temperature is about 38 degrees F, and the average growing season (at 28 degrees) is 60 to 90 days.

This unit is about 65 percent Prouty Variant silt loam, 5 to 40 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Prouty Variant silt loam that has a slope of less than 5 percent or more than 40 percent, Conto silt loam, Conto Variant sandy loam, and Huckleberry silt loam. Also included are very stony and very shallow soils near the Rock outcrop. Included areas make up about 15 percent of the unit.

This Prouty Variant soil is moderately deep and well drained. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from limestone. Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 10 inches, the surface layer is strong brown silt loam. The subsoil is yellowish brown gravelly silt loam about 3 inches thick. The substratum is light olive brown extremely gravelly sandy loam about 17 inches thick. Limestone is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Prouty Variant soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium. and the hazard of water erosion is moderate.

The Rock outcrop consists mainly of areas of exposed limestone.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on the Prouty Variant soil. Among the trees of limited extent are western hemlock, western larch, grand fir, lodgepole pine, western redcedar. and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 59, The

highest average growth rate for Douglas fir is 42 cubic feet per acre per year at age 111. Based on a 50-year site curve, the mean site index for western larch is 64. The highest average growth rate for western larch is 55 cubic feet per acre per year at age 115. Based on a 100-year site curve, the mean site index for lodgepole pine is 87. The highest average growth rate for lodgepole pine is 102 cubic feet per acre per year at age 100. The typical basal area of trees on the Prouty Variant soil is about 55 percent of that in a normal stand of Douglas fir, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for subalpine fir and Engelmann spruce have not been made. The forest understory is mainly pachystima, common beargrass, ceanothus, common snowberry, pinegrass, huckleberry, strawberry, Saskatoon serviceberry, green fescue, rusty menziesia, common princes pine, longtube twinflower, and elk sedge.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the Rock outcrop, and the slope, which hinders the use of skidding equipment. Using standard wheeled or tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir. subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce.. western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed. Because rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

The Prouty Variant soil is in capability subclass Vle, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

103-Prouty Variant-Rock outcrop complex, 40 to 65 percent slopes. This map unit is on the foot slopes and ridgetops of mountains. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 4,400 to 5,500 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is about 38 degrees F, and the average growing season (at 28 degrees) is 60 to 90 days.

This unit is about 65 percent Prouty Variant silt loam, 40 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Prouty Variant silt loam that has a slope of less than 40 percent or more than 65 percent, Conto silt loam, Conto Variant sandy loam, and Huckleberry silt loam. Also included are very stony and very shallow soils near the Rock outcrop. Included areas make up about 15 percent of the unit.

This Prouty Variant soil is moderately deep and well drained. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from limestone. Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 10 inches, the surface layer is strong brown silt loam. The subsoil is yellowish brown gravelly silt loam about 3 inches thick. The substratum is light olive brown extremely gravelly sandy loam about 17 inches thick. Limestone is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Prouty Variant soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed limestone.

This unit is used for woodland, recreation. watershed. and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on the Prouty Variant soil. Among the trees of limited extent are western hemlock, western larch, grand fir, lodgepole pine, western

redcedar, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 59. The highest average growth rate for Douglas fir is 42 cubic feet per acre per year at age 111. Based on a 50-year site curve, the mean site index for western larch is 64. The highest average growth rate for western larch is 55 cubic feet per acre per year at age 115. Based on a 100-year site curve, the mean site index for lodgepole pine is 87. The highest average growth rate for lodgepole pine is 102 cubic feet per acre per year at age 100. The typical basal area of trees on the Prouty Variant soil is about 55 percent of that in normal stands of Douglas fir, subalpine fir, and lodgepole pine, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for subalpine fir and Engelmann spruce have not been made. The forest understory is mainly pachystima, common beargrass, ceanothus, common snowberry, pinegrass, huckleberry, strawberry, Saskatoon serviceberry, green fescue, rusty menziesia, common princes pine, longtube twinflower, and elk sedge.

The main limitations affecting timber harvesting are the Rock outcrop and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

The Prouty Variant soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

104-Pywell muck. This very deep, very poorly drained soil is in the depressions of flood plains, in old lake basins, and on the perimeter of lakes. It formed in organic material derived dominantly from herbaceous plants. Slope is 0 to 3 percent. The native vegetation is scattered conifers, deciduous trees, shrubs, forbs, and grasses. Elevation is 1,900 to 2,800 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 80 to 110 days.

Typically, the surface tier is muck about 10 inches thick. It is black when moist. The subsurface tier is muck about 6 inches thick. It is very dark gray when moist. The next tier is muck about 20 inches thick. It is very dark grayish brown when moist. The bottom tier to a depth of 60 inches or more is muck that is black when moist.

Included in this unit are small areas of Blueslide silt loam, Hoodoo silt loam, Rathdrum very fine sandy loam, and Uncas muck. Included areas make up about 15 percent of the unit.

Permeability is moderate in the Pywell soil. Available water capacity is very high. The effective rooting depth is limited by a seasonal high water table that is 1 foot above the surface to 1 foot below from September through June. Runoff is very slow, and the hazard of water erosion is slight.

This unit is used for rangeland, recreation, watershed, and wildlife habitat.

This unit is suitable as rangeland. The native vegetation includes scattered conifers, such as western redcedar and Engelmann spruce, and quaking aspen, black cottonwood, willow, alder, Douglas spirea, cattail, sedge, and reed. Most areas have been cleared, however, and support sedge, rush, Douglas spirea, and reed canarygrass. Overgrazing causes the desirable plants, such as sedge and reed canarygrass, to decrease in extent and the less desirable plants to increase. Wetness can limit access by livestock. Compaction occurs in areas that are grazed or browsed when the soil is wet. Wetness limits the choice of plants and the period of cutting or grazing. It also increases the likelihood that plants will be damaged by frost heaving or submergence. Spreading manure and periodic clipping help to maintain uniform plant growth and discourage selective grazing. Seeding suitable

plants in recently disturbed areas can provide desirable forage. Seedbed preparation and seeding are hindered by the seasonal wetness. A firm, well packed seedbed and a drill that has a depth regulator can improve the likelihood that seeding will be successful.

The capability subclass is Vw, nonirrigated.

105-Raisio channery loam, 10 to 40 percent slopes. This moderately deep, well drained soil is on the toe slopes and foot slopes of foothills and mountains. It formed in colluvium and residuum derived dominantly from metasedimentary rock, including phyllite, shale, argillite, and slate. The residuum and colluvium have an admixture of volcanic ash and loess. In some areas the soil is modified by glacial till. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, grasses, forbs, and shrubs. Elevation is 2,000 to 4,500 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 47 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is grayish brown channery loam about 5 inches thick. The subsoil is brown very flaggy loam about 4 inches thick. The upper 17 inches of the substratum is pale brown extremely flaggy loam. The lower part is light brownish gray extremely flaggy loam about 10 inches thick. Phyllite is at a depth of about 36 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Raisio channery loam that has a slope of less than 10 percent or more than 40 percent, Rufus channery loam, and Inkler gravelly silt loam. Also included is Rock outcrop on knobs. Included areas make up about 15 percent of the unit.

Permeability is moderate in this Raisio soil. Available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir and ponderosa pine are the main woodland species on this unit. Among the trees of limited extent is western larch. Based on a 50-year site curve, the mean site index for Douglas fir is 65. The highest average growth rate for Douglas fir is 52 cubic feet per acre per year at age 106. Based on a 100-year site curve, the mean site index for ponderosa pine is 87. The highest average growth rate for ponderosa pine is 80 cubic feet per acre per year at age 40. The typical basal area of trees is about 45 percent of that in normal stands of Douglas fir and ponderosa pine. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. Occasional snowpack hinders the use of equipment in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir and ponderosa pine occurs periodically. Reforestation can be accomplished by planting Douglas fir or ponderosa pine seedlings. The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly bluebunch wheatgrass, pinegrass, mallow ninebark, ceanothus, needleandthread, red threeawn, Columbia needlegrass, arrowfeaf balsamroot, currant, lupine, common snowberry, creambush oceanspray, and Saskatoon serviceberry. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Columbia needlegrass, mallow ninebark, and pinegrass, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting is the most effective seeding method.

The main limitations on homesites are the slope, the depth to bedrock, and large stones. Special designs for buildings may be needed to overcome the slope. The cuts needed to provide essentially level building sites can expose the bedrock. Flagstones can interfere with excavation.

Septic tank absorption fields cannot function properly because of the depth to the bedrock, the slope, and the large stones. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is Vle, nonirrigated.

106-Raisio channery loam, 40 to 65 percent slopes. This moderately deep, well drained soil is on the back slopes of foothills and mountains. It formed in colluvium and residuum derived dominantly from metasedimentary rock, including phyllite, shale, argillite, and slate. The residuum and colluvium have an admixture of volcanic ash and loess. In some areas the soil is modified by glacial till. Slopes are convex or concave and generally have south and west aspects. The native vegetation is mainly conifers, grasses, forbs, and shrubs. Elevation is 2,000 to 4,500 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 47 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is grayish brown channery loam about 5 inches thick. The subsoil is brown very flaggy loam about 4 inches thick. The upper 17 inches of the substratum is pale brown extremely flaggy loam. The lower part is light brownish gray extremely flaggy loam about 10 inches thick. Phyllite is at a depth of about 36 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Raisio channery loam that has a slope of less than 40 percent or more than 65 percent, Rufus channery loam, and Inkler gravelly silt loam. Also included is Rock outcrop on ridges and knobs. Included areas make up about 15 percent of the unit.

Permeability is moderate in this Raisio soil. Available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir and ponderosa pine are the main woodland species on this unit. Among the trees of limited extent is western larch. Based on a 50-year site curve, the mean site index for Douglas fir is 65. The highest average growth rate for Douglas fir is 52 cubic feet per acre per year at age 106. Based on a 100-year site curve, the mean site index for ponderosa pine is 87. The highest average growth rate for ponderosa pine is 80 cubic feet per acre per year at age 40. The typical basal area of trees is about 45 percent of that in normal stands of Douglas fir and ponderosa pine. Per acre productivity is reduced accordingly.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. Occasional snowpack hinders the use of equipment in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir and ponderosa pine occurs periodically. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly bluebunch wheatgrass, pinegrass, mallow ninebark, ceanothus, needleandthread, red threeawn, Columbia needlegrass, arrowleaf balsamroot, currant, lupine, common snowberry, creambush oceanspray, and Saskatoon serviceberry. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Columbia needlegrass, mallow ninebark, and pinegrass, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIe, nonirrigated.

107-Raisio-Rock outcrop complex, 25 to 40 percent slopes. This map unit is on the foot slopes and ridgetops of foothills and mountains. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, grasses, forbs, and shrubs. Elevation is 2,000 to 4,500 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 47 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

This unit is about 65 percent Raisio channery loam, 25 to 40 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Raisio gravelly loam that has a slope of less than 25 percent or more than 40 percent, Rufus gravelly loam, and Inkler gravelly silt loam. Also included are very shallow and very stony soils near the Rock outcrop. Included areas make up about 15 percent of the unit.

This Raisio soil is moderately deep and well drained. It formed in colluvium and residuum derived dominantly from metasedimentary rock, including phyllite, shale, argillite, and slate. The residuum and colluvium have an admixture of volcanic ash and loess. In some areas the soil is modified by glacial till. Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is grayish brown channery loam about 5 inches thick. The subsoil is brown very flaggy loam about 4 inches thick. The upper 17 inches of the substratum is pale brown extremely flaggy loam. The lower part is light brownish gray extremely flaggy loam about 10 inches thick. Phyllite is at a depth of about 36 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Raisio soil. Available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

The Rock outcrop consists mainly of exposed shaly rock.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir and ponderosa pine are the main woodland species on the Raisio soil. Among the trees of limited extent is western larch. Based on a 50-year site curve, the mean site index for Douglas fir is 65. The highest average growth rate for Douglas fir is 52 cubic feet per acre per year at age 106. Based on a 100-year site curve, the mean site index for ponderosa pine is 87. The highest average growth rate for ponderosa pine is 80 cubic feet per acre per year at age 40. The typical basal area of trees on the Raisio soil is about 45 percent of that in normal stands of Douglas fir and ponderosa pine, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the Rock outcrop, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir and ponderosa pine occurs periodically. Reforestation can be accomplished by planting Douglas fir or ponderosa pine seedlings. The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly bluebunch wheatgrass, pinegrass, mallow ninebark, ceanothus, needleandthread, arrowleaf balsamroot, currant, lupine, common snowberry, creambush oceanspray, and Saskatoon serviceberry. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Columbia needlegrass, mallow ninebark, and pinegrass, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the Rock outcrop and the slope. Broadcasting is the most effective seeding method.

The Raisio soil is in capability subclass Vle, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

108-Raisio-Rock outcrop complex, 40 to 65 percent slopes. This map unit is on the back slopes and ridgetops of foothills and mountains. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,500 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 47 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

This unit is about 65 percent Raisio channery loam, 40 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so

intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Raisio channery loam that has a slope of less than 40 percent or more than 65 percent, Rufus channery loam, and Inkler gravelly silt loam. Also included are very shallow and very stony soils near the Rock outcrop. Included areas make up about 15 percent of the unit.

This Raisio soil is moderately deep and well drained. It formed in colluvium and residuum derived dominantly from metasedimentary rock, including phyllite, shale, argillite, and slate. The residuum and colluvium have an admixture of volcanic ash and loess. In some areas the soil is modified by glacial till. Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is grayish brown channery loam about 5 inches thick. The subsoil is brown very flaggy loam about 4 inches thick. The upper 17 inches of the substratum is pale brown extremely flaggy loam. The lower part is light brownish gray extremely flaggy loam about 10 inches thick. Phyllite is at a depth of about 36 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Raisio soil. Available water capacity is very low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed shaly rock.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir and ponderosa pine are the main woodland species on the Raisio soil. Among the trees of limited extent is western larch. Based on a 50-year site curve, the mean site index for Douglas fir is 65. The highest average growth rate for Douglas fir is 52 cubic feet per acre per year at age 106. Based on a 100-year site curve, the mean site index for ponderosa pine is 87. The highest average growth rate for ponderosa pine is 80 cubic feet per acre per year at age 40. The typical basal area of trees on the Raisio soil is about 45 percent of that in normal stands of Douglas fir and ponderosa pine, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are the Rock outcrop and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir and ponderosa pine occurs periodically. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. The very low available water capacity reduces the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly bluebunch wheatgrass, pinegrass, mallow ninebark, ceanothus, needleandthread, Columbia needlegrass, arrowleaf balsamroot, currant, lupine, common snowberry, creambush oceanspray, and Saskatoon serviceberry. A uniform distribution of grazing by domestic livestock is unlikely because of the slope and the Rock outcrop. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Columbia needlegrass, mallow ninebark, and pinegrass, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope and the Rock outcrop. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Raisio soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

109-Rathdrum very fine sandy loam. This very deep, well drained soil is in the depressions of outwash plains and terraces adjacent to perennial streams. It formed in alluvium derived dominantly from volcanic ash and loess over glacial outwash. Slope is 0 to 3 percent. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 2,600 feet. The average annual precipitation is 25 to 32 inches, the average annual air temperature is about 44 degrees F,

the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is pale brown very fine sandy loam about 6 inches thick. The subsoil is pale brown very fine sandy loam about 16 inches thick. The upper 20 inches of the substratum is very pale brown very fine sandy loam. The lower part to a depth of 60 inches or more is very pale brown fine sandy loam.

Included in this unit are small areas of Bonner silt loam, Dalkena fine sandy loam, Scotia fine sandy loam, and Scrabblers silt loam. Included areas make up about 20 percent of the unit.

Permeability is moderate in the Rathdrum soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight.

This unit is used for grazable woodland, nonirrigated and irrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the estimated mean site index for western larch is 90. The highest average growth rate for western larch is 130 cubic feet per acre per year at age 70. The typical basal area of trees is about 65 percent of that in a normal stand of western larch. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for Douglas fir and western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and can delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly thimbleberry, common snowberry, pachystima, huckleberry, sedge, western brackenfern, longtube twinflower, pinegrass, and rose. Overgrazing causes the desirable plants, such as pinegrass, rose, and sedge, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated and irrigated wheat, barley, oats, and grass-legume hay. The main management concern is the hazard of water erosion. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Stripcropping and diversions or terraces may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation and leaching of plant nutrients.

This unit is well suited to homesite development.

The capability subclass is IIIe, irrigated and nonirrigated.

110-Riverwash. This map unit is on the bottom land adjacent to perennial and intermittent streams. It consists mainly of stratified alluvium of mixed mineralogy. Slope is 0 to 3 percent. The native vegetation is widely distributed deciduous trees, shrubs, forbs, and grasses. Elevation is 1,800 to 4,500 feet. The average annual precipitation is 20 to 45 inches, the average annual air temperature is about 43 degrees F, and the average growing season (at 28 degrees) is 60 to 120 days.

Typically, the upper 60 inches or more is stratified silt, sand, pebbles, and cobbles.

Included in this unit are small areas of poorly drained and very poorly drained soils.

Permeability and available water capacity vary in this unit. A seasonal high water table is within a depth of 2 feet throughout the year. The unit is subject to long or very long periods of flooding from October through July. Runoff is slow.

This unit is used for wildlife habitat, for recreation, and as a source of sand and gravel. The capability subclass is VIIIw, nonirrigated.

111-Roaring silt loam, 5 to 30 percent slopes. This very deep, well drained soil is on terraces. It formed in a thick mantle of volcanic ash and loess over sandy glacial outwash derived dominantly from granitic rock. Slopes are convex. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,500 to 6,000 feet. The average annual precipitation is 35 to 45 inches, the average annual air temperature is about 38 degrees F, and the average growing season (at 28 degrees) is 60 to 90 days.

Typically, the surface is covered with a mat of organic material about 2 inches thick. When mixed to a depth of about 4 inches, the surface layer is brown silt loam. The upper 8 inches of the subsoil also is brown silt loam. The lower 16 inches is pale brown sandy loam. The upper 29 inches of the substratum is light gray gravelly loamy coarse sand. The lower part to a depth of 60 inches or more is light gray very gravelly loamy fine sand.

Included in this unit are small areas of Roaring silt loam that has a slope of less than 5 percent or more than 30 percent and soils that are similar to Orwig sandy loam but are in areas where summer temperatures are cooler. Also included are poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate to a depth of 28 inches in this Roaring soil and moderately rapid below that depth. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir and western hemlock are the main woodland species on this unit. Among the trees of limited extent are subalpine fir, Engelmann spruce, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 80. The highest average growth rate for Douglas fir is 112 cubic feet per acre per year at age 87. Based on a 50-year site curve, the mean site index for western larch is 74. The highest average growth rate for western larch is 109 cubic feet per acre per year at age 70. The typical basal area of trees is about 60 percent of that in a normal stand of Douglas fir. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for subalpine fir and western hemlock have not been made. The forest understory is mainly pachystima, creambush oceanspray, Saskatoon serviceberry, redosier dogwood, mallow ninebark, common beargrass, kinnikinnick, Oregongrape, strawberry, common snowberry, huckleberry, and thimble berry.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and western hemlock occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

The capability subclass is VIs, nonirrigated.

112-Roaring silt loam, 30 to 65 percent slopes. This very deep, well drained soil is on terrace escarpments. It formed in a thick mantle of volcanic ash and loess over sandy glacial outwash derived dominantly from granitic rock. Slopes are convex. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,500 to 6,000 feet. The average annual precipitation is 35 to 45 inches, the average annual air temperature is about 38 degrees F, and the average growing season (at 28 degrees) is 60 to 90 days.

Typically, the surface is covered with a mat of organic material about 2 inches thick. When mixed to a depth of about 4 inches, the surface layer is brown silt loam. The upper 8 inches of the subsoil also is brown silt loam. The lower 16 inches is pale brown sandy loam. The upper 29 inches of the substratum is light gray gravelly loamy coarse sand. The lower part to a depth of 60 inches or more is light gray very gravelly loamy fine sand.

Included in this unit are small areas of Roaring silt loam that has a slope of less than 30 percent or more than 65 percent. Also included are soils that are similar to the Roaring soil but do not have a surface layer of silt loam, soils that are similar to Bonner gravelly silt loam but are in areas where summer temperatures are

cooler, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate to a depth of 28 inches in this Roaring soil and moderately rapid below that depth. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and western hemlock are the main woodland species on this unit. Among the trees of limited extent are Engelmann spruce, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 80. The highest average growth rate for Douglas fir is 112 cubic feet per acre per year at age 87. Based on a 50-year site curve, the mean site index for western larch is 74. The highest average growth rate for western larch is 109 cubic feet per acre per year at age 70. The typical basal area of trees is about 60 percent of that in a normal stand of Douglas fir. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for subalpine fir and western hemlock have not been made. The forest understory is mainly pachystima, creambush oceanspray, Saskatoon serviceberry, redosier dogwood, mallow ninebark, common beargrass, kinnikinnick, Oregongrape, strawberry, common snowberry, huckleberry, and thimbleberry.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. When saturated, cutbanks can slump and fill slopes can fail.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and western hemlock occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

The capability subclass is VIIe, nonirrigated.

113-Rock outcrop. This map unit is on foothills and mountains. It consists mainly of exposed granitic rock, quartzite, phyllite, limestone, shale, or amphibolite. Slopes are nearly level to vertical. The native vegetation is widely distributed forbs and grasses. Elevation is 1,800 to 6,500 feet. The average annual precipitation is 24 to 55 inches, and the average annual air temperature is about 42 degrees F.

Included in this unit are small areas of Rubble land and shallow soils. Included areas make up about 10 percent of the unit.

Runoff is very rapid on the Rock outcrop. This unit is used for wildlife habitat.

The capability subclass is VIIIs, nonirrigated.

114-Rock outcrop-Aits, high precipitation, complex, 30 to 65 percent slopes. This map unit is on the back slopes of foothills and mountains. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 5,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

This unit is about 50 percent Rock outcrop and about 35 percent Aits stony loam, high precipitation, 30 to 65 percent slopes. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Aits stony loam that has a slope of less than 30 percent or more than 65 percent, Newbell stony silt loam, Smackout loam, and Waits loam. Also included are Hartill silt loam on the upper parts of the slopes, Inkler gravelly silt loam on south- and west-facing slopes, very stony and very shallow soils near the Rock outcrop, Rubble land downslope from the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

The Rock outcrop consists mainly of exposed granitic rock, quartzite, and shale.

The Aits soil is very deep and well drained. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Typically, the surface is covered with a mat of organic material about 1/2 inch thick. When mixed to a depth of about 6 inches, the surface layer is brown stony loam. The upper 6 inches of the subsoil is light brown stony loam. The lower 18 inches is very

pale brown gravelly loam. The substratum to a depth of 60 inches or more is light yellowish brown gravelly loam.

Permeability is moderately slow in the Aits soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland: recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on the Aits soil. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 88. The highest average growth rate for Douglas fir is 99 cubic feet per acre per year at age 91. Based on a 50-year site curve, the mean site index for western larch is 75. The highest average growth rate for western larch is 111 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 123. The highest average growth rate for ponderosa pine is 148 cubic feet per acre per year at age 40. The typical basal area of trees is about 75 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are the stones, the Rock outcrop, and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. The Rock outcrop and the stones on the surface can hinder harvesting. Also, falling timber can break on the Rock outcrop and the stones.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed.

This unit is suited to grazing and browsing. The forest understory is mainly creambush oceanspray, pinegrass, common snowberry, rose, Douglas maple, Oregongrape, mallow ninebark, white spirea, kinnikinnick, Saskatoon serviceberry, ceanothus, and pachystima. A uniform distribution of grazing by domestic livestock is unlikely because of the slope and the Rock outcrop. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, Saskatoon serviceberry, rose, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope, the stones on the surface, and the Rock outcrop. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Rock outcrop is in capability subclass VIIIs. The Aits soil is in capability subclass VIIe, nonirrigated.

115-Rock outcrop-Huckleberry complex, 30 to 65 percent slopes. This map unit is on the back slopes of mountains. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 6,000 feet. The average annual precipitation is 30 to 45 inches, the average annual air temperature is about 39 degrees F, and the average growing season (at 28 degrees) is 70 to 90 days.

This unit is about 55 percent Rock outcrop and about 30 percent Huckleberry silt loam, 30 to 65 percent slopes. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Huckleberry silt loam that has a slope of less than 30 percent or more than 65 percent, Buhrig very stony loam, Manley silt loam, and Vassar silt loam. Also included are Brickel stony loam on south- and west-facing shoulder slopes, very stony and very shallow soils near the Rock outcrop, Rubble land downslope from the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

The Rock outcrop consists mainly of exposed phyllite or quartzite.

The Huckleberry soil is moderately deep and well drained. It formed in a thick mantle of volcanic ash and

loess over residuum and colluvium derived dominantly from phyllite and quartzite. Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. When mixed to a depth of about 5 inches, the surface layer is yellowish brown silt loam. The upper 7 inches of the subsoil also is yellowish brown silt loam. The lower 4 inches is light yellowish brown silt loam. The upper 6 inches of the substratum is very pale brown shaly loam. The lower 8 inches is very pale brown very flaggy loam. Phyllite is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas, mostly at the lowest elevations, summer temperatures are warmer.

Permeability is moderate in the Huckleberry soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on the Huckleberry soil. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 76. The highest average growth rate for Douglas fir is 73 cubic feet per acre per year at age 99. The typical basal area of trees on the Huckleberry soil is about 90 percent of that in a normal stand of Douglas fir, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for subalpine fir and Engelmann spruce have not been made. The forest understory is mainly creambush oceanspray, common snowberry, ceanothus, pinegrass, huckleberry, Douglas maple, mallow ninebark, Oregongrape, kinnikinnick, thimbleberry, pachystima, and elk sedge.

The main limitations affecting timber harvesting are the Rock outcrop and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, and western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

The Rock outcrop is in capability subclass VIIIs. The Huckleberry soil is in capability subclass VIIe, nonirrigated.

116-Rock outcrop-Manley complex, 30 to 65 percent slopes. This map unit is on the back slopes of mountains. Slopes are convex or concave and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,500 to 6,500 feet. The average annual precipitation is 28 to 45 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 80 to 90 days.

This unit is about 50 percent Rock outcrop and about 35 percent Manley silt loam, 30 to 65 percent slopes. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Manley silt loam that has a slope of less than 30 percent or more than 65 percent and Vassar silt loam. Also included are Brickel stony loam, Buhrig very stony loam, and Prouty extremely bouldery silt loam on the upper parts of the slopes,, very stony and very shallow soils near the Rock outcrop; and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

The Rock outcrop consists mainly of exposed granitic rock.

The Manley soil is very deep and well drained. It formed in a thick mantle of volcanic ash and loess over glacial till of mixed mineralogy. Typically, the surface is covered with a mat of organic material about 2 inches thick. When mixed to a depth of about 8 inches, the surface layer is brown silt loam. The subsoil also is brown silt loam. It is about 8 inches thick. The upper 10

inches of the substratum is light yellowish brown very gravelly sandy loam. The lower part to a depth of 60 inches or more is very pale brown very gravelly sandy loam.

Permeability is moderate in the Manley soil. Available water capacity is moderate or high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on the Manley soil. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 79. The highest average growth rate for Douglas fir is 79 cubic feet per acre per year at age 98. Based on a 50-year site curve, the mean site index for western larch is 70. The highest average growth rate for western larch is 101 cubic feet per acre per year at age 70. The Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for subalpine fir and Engelmann spruce have not been made. The forest understory is mainly pinegrass, Saskatoon serviceberry, Oregongrape, ceanothus, mallow ninebark, pachystima, thimbleberry, huckleberry, elk sedge, kinnikinnick, rose, and creambush oceanspray.

The main limitations affecting timber harvesting are the Rock outcrop and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed.

The Rock outcrop is in capability subclass VIIIs. The Manley soil is in capability subclass VIIe, nonirrigated.

117-Rock outcrop-Moscow complex, 30 to 65 percent slopes. This map unit is on the back slopes and ridgetops of foothills and mountains. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,200 to 4,000 feet. The average annual precipitation is 27 to 30 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 80 to 100 days.

This unit is about 55 percent Rock outcrop and about 30 percent Moscow silt loam, 30 to 65 percent slopes. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Moscow silt loam that has a slope of less than 30 percent or more than 65 percent and Mobate gravelly loam. Also included are Merkel stony sandy loam on back slopes, Newbell silt loam on back slopes, Moso silt loam on lower parts of back slopes and in concave areas, Usk stony loam on south- and west-facing slopes, silty glaciolacustrine soils and sandy glaciofluvial soils on terrace remnants on the lower parts of back slopes, very stony and very shallow soils near the Rock outcrop, and poorly drained soils in draws adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

The Rock outcrop consists mainly of exposed granitic rock.

The Moscow soil is moderately deep and well drained. It formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from granitic rock. Typically, the surface is covered with a mat of organic material about 1 1/4 inches thick. The surface layer is brown silt loam about 8 inches thick. The upper 4 inches of the subsoil is yellowish brown silt loam. The lower 15 inches is light yellowish brown gravelly sandy loam. Weathered granite is at a depth of about 27 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Moscow soil. Available water capacity is low. The effective rooting

depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on the Moscow soil. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 80. The highest average growth rate for Douglas fir is 81 cubic feet per acre per year at age 97. Based on a 50-year site curve, the mean site index for western larch is 71. The highest average growth rate for western larch is 103 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 100. The highest average growth rate for ponderosa pine is 102 cubic feet per acre per year at age 40. The typical basal area of trees on the Moscow soil is about 95 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are the Rock outcrop and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, ponderosa pine, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly Oregongrape, common snowberry, ceanothus, pinegrass, mallow ninebark, strawberry, Douglas maple, kinnikinnick, creambush oceanspray, Saskatoon serviceberry, pachystima, spirea, rose, and huckleberry. A uniform distribution of grazing by domestic livestock is limited by the slope and the Rock outcrop. Overgrazing causes the desirable plants, such as pinegrass, mallow ninebark, Saskatoon serviceberry, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope and the Rock outcrop. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Rock outcrop is in capability subclass VIIIs. The Moscow soil is in capability subclass VIIe, nonirrigated.

118-Rock outcrop-Newbell complex, 30 to 65 percent slopes. This map unit is on the back slopes of foothills and mountains. Slopes are convex and generally have north and east aspects at the lower elevations and south and west aspects at the higher elevations. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 100 days.

This unit is about 55 percent Rock outcrop and about 30 percent Newbell stony silt loam, 30 to 65 percent slopes. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Newbell stony silt loam that has a slope of less than 30 percent or more than 65 percent, Aits stony loam, and Scrabblers silt loam. Also included are Inkler gravelly silt loam on south- and west-facing slopes, Merkel stony sandy loam on the lower parts of the slopes, Moscow silt loam on the upper parts of the slopes, very stony and very shallow soils near the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

The Rock outcrop consists mainly of exposed granitic rock.

The Newbell soil is very deep and well drained. It formed in a mantle of volcanic ash and loess over

glacial till of mixed mineralogy. Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is yellowish brown stony silt loam about 6 inches thick. The subsoil is light yellowish brown stony silt loam about 6 inches thick. The upper 6 inches of the substratum is very pale brown very gravelly sandy loam. The lower part to a depth of 60 inches or more is light gray very gravelly sandy loam. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Permeability is moderate in the Newbell soil. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and western redcedar are the main woodland species on the Newbell soil. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 82. The highest average growth rate for Douglas fir is 86 cubic feet per acre per year at age 96. Based on a 50-year site curve, the mean site index for western larch is 85. The highest average growth rate for western larch is 132 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 103. The highest average growth rate for ponderosa pine is 108 cubic feet per acre per year at age 40. The typical basal area of trees on the Newbell soil is about 95 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are the Rock outcrop, the stones, and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop and the stones can hinder harvesting. Also, falling timber can break on the Rock outcrop and the stones.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, ceanothus, common snowberry, mallow ninebark, creambush oceanspray, huckleberry, elk sedge, strawberry, Oregongrape, kinnikinnick, and pachystima. A uniform distribution of grazing by domestic livestock is unlikely because of the slope and the Rock outcrop. Overgrazing causes the desirable plants, such as pinegrass, elk sedge, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope, the Rock outcrop, and the stones on the surface. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Rock outcrop is in capability subclass VIIIs. The Newbell soil is in capability subclass VIIs, nonirrigated.

119-Rock outcrop-Orthents complex, 50 to 90 percent slopes. This map unit is on the back slopes of foothills and mountains. Slopes are complex. The native vegetation is mainly scattered conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 6,500 feet. The average annual precipitation is 25 to 45 inches, the average annual air temperature is about 42 degrees F, and the average growing season (at 28 degrees) is 70 to 90 days.

This unit is about 55 percent Rock outcrop and about 30 percent Orthents, 50 to 90 percent slopes. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Orthents that have a slope of less than 50 percent or more than 90 percent, Buhrig very stony loam, Hartill silt loam, Huckleberry silt loam, Inkler gravelly silt loam. Raisio channery loam, and Rufus channery loam. Also included are very stony and very shallow soils near the Rock outcrop. Because the Orthents occur throughout a

wide geographic area, not all of the inclusions are likely to occur in each mapped area. Included areas make up about 15 percent of the unit.

The Rock outcrop consists mainly of exposed granitic rock, quartzite, and phyllite.

The Orthents are shallow and well drained. They formed in residuum and colluvium derived dominantly from granitic rock, shaly rock, quartzite, dolomite, or limestone. The residuum and colluvium have an admixture of volcanic ash and loess. No single profile is typical of these soils. In one commonly observed in the survey area, however, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is grayish brown shaly loam about 3 inches thick. The underlying material is pale brown very shaly loam about 10 inches thick. Bedrock is at a depth of about 13 inches. The depth to bedrock ranges from 6 to 20 inches. The texture, color, and thickness of the layers of these soils vary widely from one area to another and occasionally within short distances. The surface layer is shaly loam to extremely shaly sandy loam. The underlying material is shaly loam to extremely flaggy sandy loam. In some areas the rock fragments are rounded or subangular.

Permeability is moderate in the surface layer of the Orthents and moderately rapid below the surface layer. Available water capacity is very low. The effective rooting depth is 6 to 20 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for recreation, watershed, and wildlife habitat.

The Rock outcrop is in capability subclass VIIIs. The Orthents are in capability subclass VIIs, nonirrigated.

120-Rock outcrop-Prouty complex, 30 to 65 percent slopes. This map unit is on the back slopes and ridgetops of mountains. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 45 to 55 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 70 to 90 days.

This unit is about 55 percent Rock outcrop and about 30 percent Prouty extremely bouldery silt loam, 30 to 65 percent slopes. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Prouty extremely bouldery silt loam that has a slope of less than 30 percent or more than 65 percent, Buhrig very stony loam, Manley bouldery silt loam, and Vassar silt loam. Also included are very stony and very shallow soils near the Rock outcrop and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

The Rock outcrop consists mainly of exposed granitic rock.

The Prouty soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from granitic rock. The residuum and colluvium have an admixture of volcanic ash and loess. Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is yellowish brown extremely bouldery silt loam about 7 inches thick. The upper 6 inches of the subsoil is light yellowish brown gravelly silt loam. The lower 4 inches is very pale brown gravelly sandy loam. The substratum is very pale brown very gravelly sandy loam about 11 inches thick. Weathered granite is at a depth of about 28 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Prouty soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on the Prouty soil. Among the trees of limited extent are western hemlock, western larch, grand fir, lodgepole pine, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for subalpine fir is 85. The highest average growth rate for subalpine fir is 84 cubic feet per acre per year at age 95. Based on a 50-year site curve, the mean site index for Engelmann spruce is 95. The highest average growth rate for Engelmann spruce is 100 cubic feet per acre per year at age 90. The Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for Douglas fir have not been made. The forest understory is mainly huckleberry, common beargrass, common snowberry, pachystima, ceanothus, pinegrass, rose, longtube twinflower, common princes pine, creambush oceanspray, and queencup beadlily.

The main limitations affecting timber harvesting are the Rock outcrop, the boulders, and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter. The Rock outcrop and the boulders

can hinder harvesting. Also, falling timber can break on the Rock outcrop and the boulders.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of the large boulders and large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. The Rock outcrop limits the distribution of reforestation. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

The Rock outcrop is in capability subclass VIIIs. The Prouty soil is in capability subclass VIIe, nonirrigated.

121-Rock outcrop-Usk complex, 30 to 65 percent slopes. This map unit is on the back slopes and ridgetops of foothills and mountains. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is 24 to 30 inches, the average annual air temperature is about 46 degrees F, and the average growing season (at 28 degrees) is 110 to 130 days.

This unit is about 55 percent Rock outcrop and about 30 percent Usk stony loam, 30 to 65 percent slopes. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Usk stony loam that has a slope of less than 30 percent or more than 65 percent, soils that are similar to Usk stony loam but are deep or very deep, and Skanid loam. Also included are Moscow silt loam and Moso silt loam in small areas on north and east aspects, very stony and very shallow soils near the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

The Rock outcrop consists mainly of exposed granitic rock.

The Usk soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from granitic rock. The residuum and colluvium have an admixture of volcanic ash and loess. Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is grayish brown stony loam about 9 inches thick. The upper 10 inches of the subsoil is pale brown gravelly loam. The lower 7 inches is light yellowish brown gravelly sandy loam. The substratum also is light yellowish brown gravelly sandy loam. It is about 6 inches thick. Highly weathered granite is at a depth of about 32 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Usk soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, watershed, wildlife habitat, and recreation.

Ponderosa pine and Douglas fir are the main woodland species on the Usk soil. Among the trees of limited extent are western larch and lodgepole pine. Based on a 100-year site curve, the mean site index for ponderosa pine is 102. The highest average growth rate for ponderosa pine is 106 cubic feet per acre per year at age 40. Based on a 50-year site curve, the estimated mean site index for Douglas fir is 90. The estimated highest average growth rate for Douglas fir is 104 cubic feet per acre per year at age 90. The typical basal area of trees on the Usk soil is about 60 percent of that in normal stands of ponderosa pine and Douglas fir, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are the Rock outcrop, the stones, and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop and the stones on the surface can hinder harvesting. Also, falling timber can break on the Rock outcrop and the stones.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to

converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine and Douglas fir occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly common snowberry, pinegrass, redstem ceanothus, mallow ninebark, bluebunch wheatgrass, Idaho fescue, rose, creambush oceanspray, arrowleaf balsamroot, willow, lupine, Saskatoon serviceberry, dogbane, Oregongrape, and pachystima. A uniform distribution of grazing by domestic livestock is unlikely because of the slope and the Rock outcrop. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Idaho fescue, pinegrass, mallow ninebark, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope, the stones on the surface, and the Rock outcrop. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Rock outcrop is in capability subclass VIIIs. The Usk soil is in capability subclass VIIe, nonirrigated.

122-Rubble land. This map unit commonly is on slopes at the base of Rock outcrop. It generally consists of fragmental rocks, including cobbles, stones, and boulders. Slope is 30 to 90 percent. The native vegetation is mainly widely distributed shrubs, forbs, and grasses. Elevation is 1,800 to 6,500 feet. The average annual precipitation is 24 to 55 inches, and the average annual air temperature is about 42 degrees F.

Typically, the upper 60 inches or more is loosely piled angular cobbles, channers, stones, flagstones, and boulders.

Included in this unit are small areas of Rock outcrop and shallow soils that have a fragmental substratum. Included areas make up about 10 percent of the unit.

Permeability is very rapid in this unit. Available water capacity is very low. Runoff is very slow.

This unit is used for wildlife habitat.

The capability subclass is VIIIs, nonirrigated.

123-Rufus channery loam, 30 to 65 percent slopes. This shallow, well drained soil is on the back slopes of foothills and mountains. It formed in colluvium and residuum derived dominantly from metasedimentary rock, including phyllite, shale, argillite, and slate. The residuum and colluvium have an admixture of volcanic ash and loess. In some areas the soil is modified by glacial till. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 46 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

Typically, the surface layer is dark grayish brown channery loam about 4 inches thick. The next layer is brown very flaggy loam about 8 inches thick. Below this is pale brown extremely flaggy loam about 2 inches thick. Phyllite is at a depth of about 14 inches. The depth to bedrock ranges from 10 to 20 inches.

Included in this unit are small areas of Rufus channery loam that has a slope of less than 30 percent or more than 65 percent, Raisio channery loam, and Inkler gravelly silt loam. Also included is Rock outcrop on knobs and ridges. Included areas make up about 15 percent of the unit.

Permeability is moderate in this Rufus soil. Available water capacity is very low. The effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Ponderosa pine and Douglas fir are the main woodland species on this unit. Based on a 100-year site curve, the mean site index for ponderosa pine is 71. The highest average growth rate for ponderosa pine is 56 cubic feet per acre per year at age 50. The typical basal area of trees is about 40 percent of that in a normal stand of ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for Douglas fir have not been made.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. Occasional snowpack hinders the use of equipment in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep

areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine and Douglas fir occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. The limited available water capacity and droughtiness on south and west aspects can significantly reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are frequently subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly Idaho fescue, bluebunch wheatgrass, lupine, pinegrass, prairie junegrass, arrowleaf balsamroot, eriogonum, phlox, stonecrop, and ceanothus. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, pinegrass, prairie junegrass, and Idaho fescue, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIe, nonirrigated.

124-Rufus-Rock outcrop complex, 30 to 65 percent slopes. This map unit is on the back slopes and ridgetops of foothills and mountains. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 46 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

This unit is about 65 percent Rufus channery loam, 30 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Rufus channery loam that has a slope of less than 30 percent or more than 65 percent, Raisio channery loam, and Inkler gravelly silt loam. Also included are very stony and very shallow soils near the Rock outcrop. Included areas make up about 15 percent of the unit.

This Rufus soil is shallow and well drained. It formed in colluvium and residuum derived dominantly from metasedimentary rock, including phyllite, shale, argillite, and slate. The residuum and colluvium have an admixture of volcanic ash and loess. In some areas the soil is modified by glacial till. Typically, the surface layer is dark grayish brown channery loam about 4 inches thick. The next layer is brown very flaggy loam about 8 inches thick. Below this is pale brown extremely flaggy loam about 2 inches thick. Phyllite is at a depth of about 14 inches. The depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Rufus soil. Available water capacity is very low. The effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed shaly rock.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Ponderosa pine and Douglas fir are the main woodland species on the Rufus soil. Based on a 100year site curve, the mean site index for ponderosa pine is 71. The highest average growth rate for ponderosa pine is 56 cubic feet per acre per year at age 50. The typical basal area of trees on the Rufus soil is about 40 percent of that in a normal stand of ponderosa pine, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for Douglas fir have not been made.

The main limitations affecting timber harvesting are the Rock outcrop and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine and Douglas fir occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. The limited available water capacity and droughtiness

on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed. Because the rooting depth is restricted by the bedrock, the trees are frequently subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly Idaho fescue, bluebunch wheatgrass, lupine, pinegrass, prairie junegrass, arrowleaf balsamroot, eriogonum, phlox, stonecrop, and ceanothus. A uniform distribution of grazing by domestic livestock is unlikely because of the slope and the Rock outcrop. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, pinegrass, prairie junegrass, and Idaho fescue, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope and the Rock outcrop. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Rufus soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

125-Sacheen loamy fine sand, 5 to 15 percent slopes. This very deep, somewhat excessively drained soil is on terraces and old alluvial fans. It formed in sandy glaciofluvial material of mixed mineralogy (fig.5). The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,400 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of partially decomposed organic material about 1 inch thick. The surface layer is dark brown loamy fine sand about 6 inches thick. The upper 6 inches of the subsoil also is dark brown loamy fine sand. The lower 12 inches is yellowish brown loamy sand. The upper 6 inches of the substratum is light yellowish brown loamy coarse sand. The lower part to a depth of 60 inches or more is light yellowish brown sand.

Included in this unit are small areas of Sacheen loamy fine sand that has a slope of less than 5 percent or more than 15 percent, Dalkena fine sandy loam, Dufort silt loam, Kaniksu sandy loam, and Scotia fine sandy loam. Also included are Rathdrum very fine sandy loam in depressions and poorly drained soils in

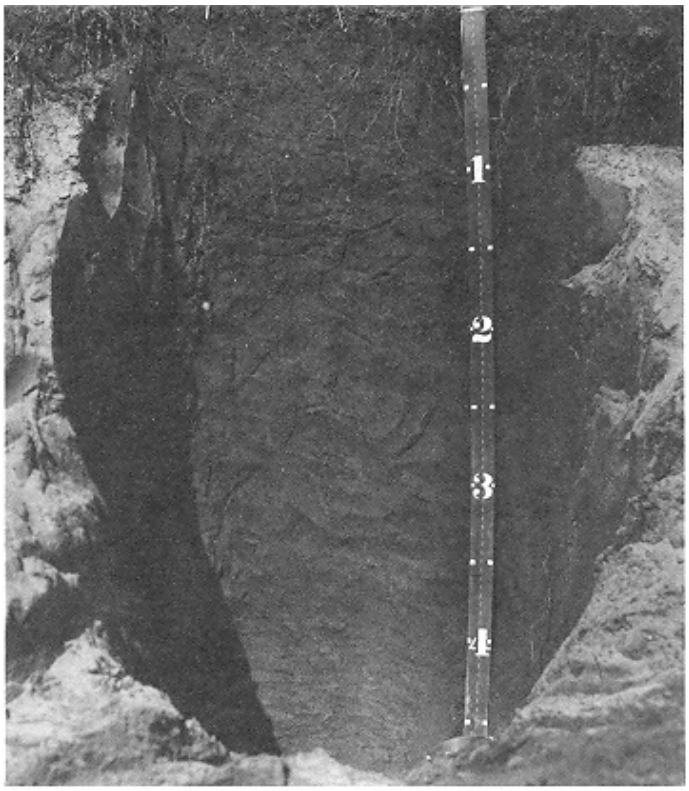

Figure 5.-Profile of Sacheen loamy fine sand, 5 to 15 percent slopes. This soil formed in sandy glaciofluvial material. Depth is marked in feet.

draws. Included areas make up about 20 percent of the unit.

Permeability is rapid to a depth of 24 inches in this Sacheen soil and very rapid below that depth. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for grazable woodland, nonirrigated and irrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Ponderosa pine and Douglas fir are the main woodland species on this unit. Among the trees of limited extent are lodgepole pine and western larch. Based on a 100-year site curve, the mean site index for ponderosa pine is 107. The highest average growth rate for ponderosa pine is 116 cubic feet per acre per year at age 40. The typical basal area of trees is about 65 percent of that in a normal stand of ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for Douglas fir have not been made.

The main limitations affecting timber harvesting are the surface layer of loamy fine sand and snowpack in

winter. Using standard wheeled and tracked equipment causes the formation of ruts and displacement of the surface layer when the soil is dry. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine and Douglas fir occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. The low available water capacity can significantly reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, ceanothus, kinnikinnick, creambush oceanspray, common snowberry, bluebunch wheatgrass, Idaho fescue, Saskatoon serviceberry, pachystima, huckleberry, phlox, and spirea. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Idaho fescue, creambush oceanspray, and pinegrass, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated and irrigated barley, oats, and grass-legume hay. The main management concerns are the low available water capacity, the hazard of water erosion, and the slope. The crops that are tolerant of drought grow best. The amount of available moisture is not adequate for most other crops to grow well. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

The main limitations on homesites are the slope and the instability of cutbanks. Special designs for buildings may be needed to overcome the slope. The sides of shallow excavations can cave in unless they are supported by special retainer walls.

The main limitations on sites for septic tank absorption fields are the slope and the very rapid permeability in the substratum. Where the slope is a concern, the absorption lines should be installed on the contour. Seepage can contaminate ground water because of the very rapid permeability.

The capability subclass is IVe, irrigated and nonirrigated.

126-Sacheen loamy fine sand, 15 to 25 percent slopes. This very deep, somewhat excessively drained soil is on terraces and old alluvial fans. It formed in sandy glaciofluvial material of mixed mineralogy. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,400 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of partially decomposed organic material about 1 inch thick. The surface layer is dark brown loamy fine sand about 6 inches thick. The upper 6 inches of the subsoil also is dark brown loamy fine sand. The lower 12 inches is yellowish brown loamy sand. The upper 6 inches of the substratum is light yellowish brown loamy coarse sand. The lower part to a depth of 60 inches or more is light yellowish brown sand.

Included in this unit are small areas of Sacheen loamy fine sand that has a slope of less than 15 percent or more than 25 percent, Dalkena fine sandy loam, Dufort silt loam, Kaniksu sandy loam, and Scotia fine sandy loam. Also included are Rathdrum very fine sandy loam in depressions and poorly drained soils in draws. Included areas make up about 20 percent of the unit.

Permeability is rapid to a depth of 24 inches in this Sacheen soil and very rapid below that depth. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated and irrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Ponderosa pine and Douglas fir are the main woodland species on this unit. Among the trees of limited extent are lodgepole pine and western larch. Based on a 100-year site curve, the mean site index for ponderosa pine is 107. The highest average growth rate for ponderosa pine is 116 cubic feet per acre per year

at age 40. The typical basal area of trees is about 65 percent of that in a normal stand of ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for Douglas fir have not been made.

The main limitations affecting timber harvesting are the surface layer of loamy fine sand and snowpack in winter. Using standard wheeled and tracked equipment causes the formation of ruts and displacement of the surface layer when the soil is dry. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. Occasional snowpack hinders the use of equipment in winter.

Establishing a plant cover in areas that have been cut and filled and in other disturbed areas reduces the hazard of sheet and rill erosion. When saturated, cutbanks can slump and fill slopes can fail.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine and Douglas fir occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. The low available water capacity can significantly reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, ceanothus, kinnikinnick, creambush oceanspray, common snowberry, bluebunch wheatgrass, Idaho fescue, Saskatoon serviceberry, pachystima, huckleberry, phlox, and spirea. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Idaho fescue, creambush oceanspray, and pinegrass, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated and irrigated barley, oats, and grass-legume hay. The main management concerns are the low available water capacity, the hazard of water erosion, and the slope. The crops that are tolerant of drought grow best. The amount of available moisture is not adequate for most other crops to grow well. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming and stripcropping may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

The main limitations on homesites are the slope and the instability of cutbanks. Special designs for buildings may be needed to overcome the slope. The sides of shallow excavations can cave in unless they are supported by special retainer walls.

Septic tank absorption fields cannot function properly because of the slope and the very rapid permeability in the substratum. The effluent can surface in downslope areas and create a health hazard. Seepage can contaminate ground water because of the very rapid permeability.

The capability subclass is VIe, irrigated, and IVe, nonirrigated.

127-Sacheen Variant silt loam. This very deep, somewhat poorly drained soil is in lake basins and on flood plains along streams. It formed in sandy alluvium of mixed mineralogy. The alluvium has an admixture of volcanic ash and loess in the upper part. Slope is 0 to 3 percent. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 2,400 feet. The average annual precipitation is 25 to 27 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface layer is light brownish gray silt loam about 4 inches thick. The subsoil is pale brown silt loam about 2 inches thick. The upper 4 inches of the substratum is light brownish gray, mottled sandy loam. The next 26 inches is pale brown, mottled coarse sand. The lower part to a depth of 60 inches or more is light brownish gray, mottled coarse sand.

Included in this unit are small areas of Blueslide silt loam, Cusick silty clay loam, and Pywell muck. Included areas make up about 15 percent of the unit.

Permeability is moderate to a depth of 10 inches in the Sacheen Variant soil and very rapid below that depth. Available water capacity is low. The effective rooting depth is limited by a seasonal high water table at a depth of 1 to 3 feet from March through June. Runoff is very slow, and the hazard of water erosion is slight. The soil is subject to occasional, brief periods of flooding from March through May.

This unit is used for nonirrigated and irrigated crops,

grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

This unit is suited to nonirrigated and irrigated oats and grass-legume hay. The main limitation is the seasonal wetness. Tile drains and open ditches have been used in most areas to remove excess surface and subsurface water where suitable outlets are available. Minimum tillage helps to prevent compaction. A tillage pan forms if the soil is tilled when wet. In some years spring planting is delayed because of the wetness. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. A common crop rotation is 8 to 10 years of grass, such as timothy, and legume hay, such as clover, and 2 or 3 years of grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

Ponderosa pine is the main woodland species on this unit. Among the trees of limited extent are lodgepole pine and western larch. Based on a 100-year site curve, the mean site index for ponderosa pine is 107. The highest average growth rate for ponderosa pine is 116 cubic feet per acre per year at age 40. The typical basal area of trees is about 65 percent of that in a normal stand of ponderosa pine. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. If roads are constructed on this unit, additional rock is needed to improve the ability of the soil to support equipment. When wet, skid trails are soft and slippery and can be impassable. The seasonal high water table restricts the use of equipment to periods when the soil is dry in the upper part or when it is protected by snowpack. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine occurs periodically. Reforestation can be accomplished by planting ponderosa pine or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the seasonal high water table, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly reed canarygrass, sedge, rush, tufted hairgrass, rose, spirea, hawthorn, and willow. Overgrazing causes the desirable plants, such as reed canarygrass, sedge, rose, and tufted hairgrass, to decrease in extent and the less desirable plants to increase. Wetness can limit access by livestock. Compaction can occur in areas that are grazed or browsed when the soil is wet. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the seasonal wetness. Broadcasting is the most effective seeding method.

The main limitations on homesites are the flooding, the seasonal wetness, and the instability of cutbanks. Buildings should be constructed above the expected level of flooding. Dikes and channels can protect buildings from flooding. Tile drains and open ditches can lower the water table if suitable outlets are available. The sides of shallow excavations can cave in unless they are supported by special retainer walls.

Septic tank absorption fields cannot function properly because of the flooding, the seasonal wetness, and the very rapid permeability. Seepage can contaminate ground water because of the very rapid permeability.

The capability subclass is IIIw, irrigated and nonirrigated.

128-Scotia fine sandy loam, 0 to 7 percent slopes. This very deep, well drained soil is on terraces. It formed in glaciofluvial material of mixed mineralogy. This material has an admixture of volcanic ash and loess in the upper part. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,400 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period is 75 to 105 days.

Typically, the surface is covered with a mat of partially decomposed organic material about 1 inch thick. The surface layer is light yellowish brown fine sandy loam about 7 inches thick. The subsoil also is light yellowish brown fine sandy loam. It is about 5 inches thick. The next 8 inches is very pale brown loamy fine sand. The next 11 inches is about 60 percent very pale brown, mottled loamy fine sand and 40 percent brown sandy loam. The lower 29 inches or more is about 75 percent very pale brown, mottled loamy sand and 25 percent brown sandy loam.

Included in this unit are small areas of Scotia fine sandy loam that has a slope of more than 7 percent,

Bonner silt loam, Dalkena fine sandy loam, Dufort silt loam, Sacheen loamy fine sand, and Scrabblers silt loam. Also included is Rathdrum very fine sandy loam in depressions. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Scotia soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for grazable woodland, nonirrigated and irrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent are grand fir and western redcedar. Based on a 50-year site curve, the mean site index for Douglas fir is 88. The highest average growth rate for Douglas fir is 99 cubic feet per acre per year at age 91. Based on a 50-year site curve, the mean site index for western larch is 77. The highest average growth rate for western larch is 116 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 117. The highest average growth rate for ponderosa pine is 135 cubic feet per acre per year at age 40. The typical basal area of trees is about 80 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for lodgepole pine have not been made.

The main limitations affecting timber harvesting are the surface layer of fine sandy loam and snowpack in winter. Using standard wheeled and tracked equipment causes the formation of ruts and displacement of the surface layer when the soil is dry. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, ponderosa pine, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, western larch, or ponderosa pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, common snowberry, huckleberry, Oregongrape, bluebunch wheatgrass, Idaho fescue, longtube twinflower, rose, spirea, ceanothus, mallow ninebark, pachystima, and kinnikinnick. Overgrazing causes the desirable plants, such as pinegrass, bluebunch wheatgrass, mallow ninebark, and Idaho fescue, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated and irrigated wheat, barley, oats, and grass-legume hay. The main management concern is the hazard of water erosion. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Stripcropping and diversions or terraces may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A suitable cropping system is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

The main limitation on homesites is the instability of cutbanks. The sides of shallow excavations can cave in unless they are supported by special retainer walls. Septic tank absorption fields can function well if they are properly installed.

The capability subclass is IIIe, irrigated and nonirrigated.

129-Scotia fine sandy loam, 7 to 15 percent slopes. This very deep, well drained soil is on terraces. It formed in glaciofluvial material of mixed mineralogy. This material has an admixture of volcanic ash and loess in the upper part. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,400 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period is 75 to 105 days.

Typically, the surface is covered with a mat of partially decomposed organic material about 1 inch thick. The surface layer is light yellowish brown fine sandy loam about 7 inches thick. The subsoil also is light yellowish brown fine sandy loam. It is about 5 inches thick. The next 8 inches is very pale brown loamy fine sand. The next 11 inches is about 60 percent very pale brown, mottled loamy fine sand and 40 percent brown sandy loam. The lower 29 inches or

more is about 75 percent very pale brown, mottled loamy sand and 25 percent brown sandy loam.

Included in this unit are small areas of Scotia fine sandy loam that has a slope of less than 7 percent or more than 15 percent, Bonner silt loam, Dalkena fine sandy loam, Dufort silt loam, Sacheen loamy fine sand, and Scrabblers silt loam. Also included is Rathdrum very fine sandy loam in depressions. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Scotia soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated and irrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent are grand fir and western redcedar. Based on a 50-year site curve, the mean site index for Douglas fir is 88. The highest average growth rate for Douglas fir is 99 cubic feet per acre per year at age 91. Based on a 50-year site curve, the mean site index for western larch is 77. The highest average growth rate for western larch is 116 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 117. The highest average growth rate for ponderosa pine is 135 cubic feet per acre per year at age 40. The typical basal area of trees is about 80 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for lodgepole pine have not been made.

The main limitations affecting timber harvesting are the surface layer of fine sandy loam and snowpack in winter. Using standard wheeled and tracked equipment causes the formation of ruts and displacement of the surface layer when the soil is dry. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, ponderosa pine, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, western larch, or ponderosa pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, common snowberry, huckleberry, Oregongrape, bluebunch wheatgrass, Idaho fescue, longtube twinflower, rose; spirea, ceanothus, mallow ninebark, pachystima, and kinnikinnick. Overgrazing causes the desirable plants, such as pinegrass, bluebunch wheatgrass, mallow ninebark, and Idaho fescue, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated and irrigated wheat, barley, oats, and grass-legume hay. The main management concerns are the hazard of water erosion and the slope. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

The main limitations on homesites are the slope and the instability of cutbanks. Special designs for buildings may be needed to overcome the slope. The sides of shallow excavations can cave in unless they are supported by special retainer walls.

The main limitation on sites for septic tank absorption fields is the slope. The absorption lines should be installed on the contour.

The capability subclasses are IVe, irrigated, and IIIe, nonirrigated.

130-Scotia fine sandy loam, 15 to 25 percent slopes. This very deep, well drained soil is on terraces. It formed in glaciofluvial material of mixed mineralogy. This material has an admixture of volcanic ash and loess in the upper part. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,400 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period is 75 to 105 days.

Typically, the surface is covered with a mat of partially decomposed organic material about 1 inch

thick. The surface layer is light yellowish brown fine sandy loam about 7 inches thick. The subsoil also is light yellowish brown fine sandy loam. It is about 5 inches thick. The next 8 inches is very pale brown loamy fine sand. The next 11 inches is about 60 percent very pale brown, mottled loamy fine sand and 40 percent brown sandy loam. The lower 29 inches or more is about 75 percent very pale brown, mottled loamy sand and 25 percent brown sandy loam.

Included in this unit are small areas of Scotia fine sandy loam that has a slope of less than 15 percent or more than 25 percent, Dalkena fine sandy loam, Dufort silt loam, Kaniksu sandy loam, Sacheen loamy fine sand, and Scrabblers silt loam. Also included is Rathdrum very fine sandy loam in depressions. Included areas make up about 25 percent of the unit.

Permeability is moderate in this Scotia soil. Available water capacity also is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated and irrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, ponderosa pine, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent are grand fir and western redcedar. Based on a 50-year site curve, the mean site index for Douglas fir is 88. The highest average growth rate for Douglas fir is 99 cubic feet per acre per year at age 91. Based on a 50-year site curve, the mean site index for western larch is 77. The highest average growth rate for western larch is 116 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for ponderosa pine is 117. The highest average growth rate for ponderosa pine is 135 cubic feet per acre per year at age 40. The typical basal area of trees is about 80 percent of that in normal stands of Douglas fir, western larch, and ponderosa pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for lodgepole pine have not been made.

The main limitations affecting timber harvesting are the surface layer of fine sandy loam and snowpack in winter. Using standard wheeled and tracked equipment causes the formation of ruts and displacement of the surface layer when the soil is dry. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, ponderosa pine, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, western larch, or ponderosa pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, common snowberry, huckleberry, Oregongrape, bluebunch wheatgrass, Idaho fescue, longtube twinflower, rose, spirea, ceanothus, mallow ninebark, pachystima, and kinnikinnick. Overgrazing causes the desirable plants, such as pinegrass, bluebunch wheatgrass, mallow ninebark, and Idaho fescue, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated and irrigated wheat, barley, oats, and grass-legume hay. The main management concerns are the hazard of water erosion and the slope. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming and stripcropping may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

The main limitations on homesites are the slope and the instability of cutbanks. Special designs for buildings may be needed to overcome the slope. The sides of shallow excavations can cave in unless they are supported by special retainer walls.

Septic tank absorption fields cannot function properly because of the slope. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is IVe, irrigated and nonirrigated.

131-Scrabblers silt loam, 0 to 20 percent slopes. This very deep, well drained soil is on terraces. It formed in a mantle of volcanic ash and loess over sandy glacial outwash derived dominantly from granitic rock. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,200 to 4,500 feet.

The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 43 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is yellowish brown silt loam about 3 inches thick. The upper 6 inches of the subsoil is light brown silt loam. The lower 4 inches is light yellowish brown sandy loam. The substratum to a depth of 60 inches or more is very pale brown gravelly loamy sand. In some areas, mostly at the highest elevations, summer temperatures are cooler.

Included in this unit are small areas of Scrabblers silt loam that has a slope of more than 20 percent, Bonner silt loam, Kaniksu sandy loam, Orwig sandy loam, Sacheen loamy fine sand, and Scotia fine sandy loam. Also included are Rathdrum very fine sandy loam in depressions and poorly drained soils in draws. Included areas make up about 20 percent of the unit.

Permeability is moderate to a depth of 9 inches in this Scrabblers soil and rapid below that depth. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated and irrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and lodgepole pine are the main woodland species on this unit. Among the trees of limited extent are grand fir, ponderosa pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 93. The highest average growth rate for Douglas fir is 112 cubic feet per acre per year at age 87. Based on a 100-year site curve, the mean site index for ponderosa pine is 111. The highest average growth rate for ponderosa pine is 124 cubic feet per acre per year at age 40. Estimates of the site index and growth rate for western larch and lodgepole pine have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and lodgepole pine occurs periodically. Reforestation can be accomplished by planting Douglas fir, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing The forest understory is mainly pinegrass, Oregongrape, common snowberry, kinnikinnick, creambush oceanspray, russet buffaloberry, Douglas maple, spirea, mallow ninebark, pachystima, rose, and ceanothus. Overgrazing causes the desirable plants, such as pinegrass, mallow ninebark, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated and irrigated barley and grass-legume hay. The main management concerns are the low available water capacity, the hazard of water erosion, and the slope. The crops that are tolerant of drought grow best. The amount of available moisture is not adequate for most other crops to grow well. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Stripcropping and diversions or terraces may be needed to control erosion on nonirrigated cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

In summer irrigation is needed for the maximum production of most crops. A sprinkler irrigation system can be used. Adjusting the rate of water application to the available water capacity, the rate of water intake, and the needs of the crop helps to prevent excessive irrigation, erosion, and leaching of plant nutrients.

The main limitations on homesites are the slope and the instability of cutbanks. Special designs for buildings may be needed to overcome the slope. The sides of shallow excavations can cave in unless they are supported by special retainer walls.

The main limitations on sites for septic tank absorption fields are the slope and the rapid permeability in the substratum. Where the slope is less than 15 percent, the absorption fields can function properly if the absorption lines are installed on the contour as needed. The absorption fields cannot

function properly on the steeper slopes. As a result, the effluent can surface in downslope areas and create a health hazard. Seepage can contaminate ground water because of the rapid permeability.

The capability subclasses are IVe, irrigated, and IIIe, nonirrigated.

132-Sherlock silt loam, 0 to 30 percent slopes. This very deep, well drained soil is on the toe slopes and foot slopes of mountains. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are plane or complex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,900 to 5,200 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 60 to 90 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 4 inches, the surface layer is yellowish brown silt loam. The upper 5 inches of the subsoil is yellow silt loam. The next 19 inches is light gray very gravelly silt loam. The lower part to a depth of 60 inches or more is pale olive very gravelly silty clay loam.

Included in this unit are small areas of Sherlock silt loam that has a slope of more than 30 percent, Conto silt loam, Conto Variant sandy loam, Huckleberry silt loam, Manley silt loam, and Prouty Variant silt loam. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Sherlock soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on this unit. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for western larch is 58. The highest average growth rate for western larch is 78 cubic feet per acre per year at age 70. Based on a 100-year site curve, the estimated mean site index for Engelmann spruce is 85. The estimated highest average growth rate for Engelmann spruce is 84 cubic feet per acre per year at age 95. Based on a 100-year site curve, the estimated mean site index for lodgepole pine is 90. The estimated highest average growth rate for lodgepole pine is 108 cubic feet per acre per year at age 100. The typical basal area of trees is about 70 percent of that in normal stands of western larch, Engelmann spruce, and lodgepole pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for Douglas fir and subalpine fir have not been made. The forest understory is mainly alder, pachystima, willow, huckleberry, Saskatoon serviceberry, thimbleberry, queencup beadlily, rose, common beargrass, Oregongrape, and sedge.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

The capability subclass is VIe, nonirrigated.

133-Sherlock silt loam, 30 to 65 percent slopes. This very deep, well drained soil is on the back slopes of mountains. It formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slopes are plane or complex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,900 to 5.200 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 60 to 90 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 4 inches, the surface layer is yellowish brown silt loam. The upper 5 inches of the subsoil is yellow silt loam. The next 19 inches is light gray very gravelly silt loam. The lower part to a depth of 60 inches or more is pale olive very gravelly silty clay loam.

Included in this unit are small areas of Sherlock silt loam that has a slope of less than 30 percent or more than 65 percent, Conto silt loam, Conto Variant sandy loam, Huckleberry silt loam, Manley silt loam, and Prouty Variant silt loam. Also included is Rock outcrop

on ridges and knobs. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Sherlock soil. Available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on this unit. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for western larch is 58. The highest average growth rate for western larch is 78 cubic feet per acre per year at age 70. Based on a 100-year site curve, the estimated mean site index for Engelmann spruce is 85. The estimated highest average growth rate for Engelmann spruce is 84 cubic feet per acre per year at age 95. Based on a 1 00-year site curve, the estimated mean site index for lodgepole pine is 90. The estimated highest average growth rate for lodgepole pine is 108 cubic feet per acre per year at age 100. The typical basal area of trees is about 70 percent of that in normal stands of western larch, Engelmann spruce, and lodgepole pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for Douglas fir and subalpine fir have not been made. The forest understory is mainly alder, pachystima, willow, huckleberry, Saskatoon serviceberry, thimbleberry, queencup beadlily, rose, common beargrass, Oregongrape, and sedge.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

The capability subclass is VIIe, nonirrigated.

134-Skanid-Rock outcrop complex, 0 to 40 percent slopes. This map unit is on the toe slopes, foot slopes, and ridgetops of foothills and mountains. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 22 to 27 inches, the average annual air temperature is about 47 degrees F, and the average growing season (at 28 degrees) is 110 to 130 days.

This unit is about 65 percent Skanid loam, 0 to 40 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Skanid loam that has a slope of more than 40 percent and Usk stony loam. Also included are Dufort very stony silt loam on toe slopes and foot slopes, Mobate gravelly loam in small areas on north and east aspects, very stony and very shallow soils near the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

This Skanid soil is shallow and well drained. It formed in residuum and colluvium derived dominantly from granitic rock. The residuum and colluvium have an admixture of volcanic ash and loess. Typically, the surface layer is grayish brown loam about 2 inches thick. The next layer is brown gravelly sandy loam about 5 inches thick. The upper 6 inches of the underlying material is pale brown very gravelly sandy loam. The lower 3 inches is pale brown very gravelly coarse sandy loam. Highly weathered granite is at a depth of about 16 inches. The depth to weathered bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Skanid soil. Available water capacity is very low. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe.

The Rock outcrop consists mainly of exposed granitic rock.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Ponderosa pine and Douglas fir are the main woodland species on the Skanid soil. Based on a 100-year site curve, the mean site index for ponderosa pine is 70. The highest average growth rate for ponderosa pine is 56 cubic feet per acre per year at age 50. The

typical basal area of trees on the Skanid soil is about 40 percent of that in a normal stand of ponderosa pine, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for Douglas fir have not been made.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the Rock outcrop, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine and Douglas fir occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. The limited available water capacity and droughtiness on south and west aspects can significantly reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are frequently subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, bluebunch wheatgrass, rose, common snowberry, Idaho fescue, strawberry, Oregongrape, spirea, creambush oceanspray, ceanothus, and lupine. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Idaho fescue, creambush oceanspray, and pinegrass, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the Rock outcrop and the slope. Broadcasting is the most effective seeding method.

The Skanid soil is in capability subclass Vle, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

135-Skanid-Rock outcrop complex, 40 to 65 percent slopes. This map unit is on the back slopes and ridgetops of foothills and mountains. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 22 to 27 inches, the average annual air temperature is about 47 degrees F, and the average growing season (at 28 degrees) is 110 to 130 days.

This unit is about 65 percent Skanid loam, 40 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Skanid loam that has a slope of less than 40 percent or more than 65 percent and Usk stony loam. Also included are Mobate gravelly loam in small areas on north and east aspects, very shallow and very stony soils near the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

This Skanid soil is shallow and well drained. It formed in residuum and colluvium derived dominantly from granitic rock. The residuum and colluvium have an admixture of volcanic ash and loess. Typically, the surface layer is grayish brown loam about 2 inches thick. The next layer is brown gravelly sandy loam about 5 inches thick. The upper 6 inches of the underlying material is pale brown very gravelly sandy loam. The lower 3 inches is pale brown very gravelly coarse sandy loam. Highly weathered granite is at a depth of about 16 inches. The depth to weathered bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Skanid soil. Available water capacity is very low. The effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed granitic rock.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Ponderosa pine and Douglas fir are the main woodland species on the Skanid soil. Based on a 100-year site curve, the mean site index for ponderosa pine is 70. The highest average growth rate for ponderosa pine is 56 cubic feet per acre per year at age 50. The typical basal area of trees on the Skanid soil is about 40 percent of that in a normal stand of ponderosa pine, and the Rock outcrop is not productive. Per acre

productivity is reduced accordingly. Estimates of the site index and growth rate for Douglas fir have not been made.

The main limitations affecting timber harvesting are the Rock outcrop and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine and Douglas fir occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. The limited available water capacity and droughtiness on south and west aspects can significantly reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are frequently subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, bluebunch wheatgrass, rose, common snowberry. Idaho fescue, strawberry, Oregongrape, spirea, creambush oceanspray, ceanothus, and lupine. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Idaho fescue, creambush oceanspray, and pinegrass, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope and the Rock outcrop. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Skanid soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

136-Smackout loam, 0 to 5 percent slopes. This very deep, well drained soil is on the toe slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over fine textured glacial till derived dominantly from shaly rock. Slopes are complex. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,500 feet. The average annual precipitation is 25 to 32 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. The surface layer is yellowish brown loam about 5 inches thick. The upper 7 inches of the subsoil also is yellowish brown loam. The next 5 inches is light brownish gray gravelly loam. The next 13 inches is light brownish gray gravelly silty clay loam. The lower 15 inches is light brownish gray gravelly sandy clay loam. The substratum to a depth of 60 inches or more is light brownish gray gravelly loam.

Included in this unit are small areas of Smackout loam that has a slope of more than 5 percent, Ahren loam, Aits loam, and Waits loam. Also included are Martella silt loam and Bonner silt loam on terrace remnants, Belzar silt loam and Hartill silt loam on the upper parts of the slopes, Rock outcrop on knobs, and poorly drained soils in draws and adjacent to springs and seeps. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Smackout soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for grazable woodland, nonirrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 80. The highest average growth rate for Douglas fir is 81 cubic feet per acre per year at age 97. Based on a 50-year site curve, the mean site index for western larch is 76. The highest average growth rate for western larch is 113 cubic feet per acre per year at age 70. The typical basal area of trees is about 70 percent of that in normal stands of Douglas fir and western larch. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, huckleberry, pachystima, willow, Oregongrape, thimbleberry, rose, ceanothus, alder, kinnikinnick, creambush oceanspray, and spirea. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, huckleberry, and rose, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated wheat, barley, and grass-legume hay. The main management concern is the hazard of water erosion. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Stripcropping and diversions or terraces may be needed to control erosion on cropland. When runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

The main limitation on homesites is the shrink-swell potential. Properly designing foundations and footings and diverting runoff away from buildings can help to prevent the structural damage caused by shrinking and swelling.

The main limitation on sites for septic tank absorption fields is the moderately slow permeability. Backfilling the trench with sandy material and enlarging the absorption fields can help to compensate for the moderately slow permeability. The capability subclass is IIIe, nonirrigated.

137-Smackout loam, 5 to 20 percent slopes. This very deep, well drained soil is on the toe slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over fine textured glacial till derived dominantly from shaly rock. Slopes are complex. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,500 feet. The average annual precipitation is 25 to 32 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. The surface layer is yellowish brown loam about 5 inches thick. The upper 7 inches of the subsoil also is yellowish brown loam. The next 5 inches is light brownish gray gravelly loam. The next 13 inches is light brownish gray gravelly silty clay loam. The lower 15 inches is light brownish gray gravelly sandy clay loam. The substratum to a depth of 60 inches or more is light brownish gray gravelly loam.

Included in this unit are small areas of Smackout loam that has a slope of less than 5 percent or more than 20 percent, Ahren loam, Aits loam, and Waits loam. Also included are Belzar silt loam and Hartill silt loam on the upper parts of the slopes, Bonner silt loam and Martella silt loam on terrace remnants, Rock outcrop on knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Smackout soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 80. The highest average growth rate for Douglas fir is 81 cubic feet per acre per year at age 97. Based on a 50-year site curve, the mean site index for western larch is 76. The highest average growth rate for western larch is 113 cubic feet per acre per year at age 70. The typical basal area of trees is about 70 percent of that in

normal stands of Douglas fir and western larch. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, huckleberry, pachystima, willow, Oregongrape, thimbleberry, rose, ceanothus, alder, kinnikinnick, creambush oceanspray, and spirea. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, huckleberry, and rose, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated wheat, barley, and grass-legume hay. The main management concerns are the hazard of water erosion and the slope. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions may be needed to control erosion on cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

The main limitations on homesites are the slope and the shrink-swell potential. Special designs for buildings may be needed to overcome the slope. Properly designing foundations and footings and diverting runoff away from buildings can help to prevent the structural damage caused by shrinking and swelling.

The main limitations on sites for septic tank absorption fields are the slope and the moderately slow permeability. Where the slope is less than 15 percent, the absorption fields can function properly if the absorption lines are installed on the contour as needed. The absorption fields cannot function properly on the steeper slopes. As a result, the effluent can surface in downslope areas and create a health hazard. Backfilling the trench with sandy material and enlarging the absorption fields can help to compensate for the moderately slow permeability.

The capability subclass is IIIe, nonirrigated.

138-Smackout loam, 20 to 40 percent slopes. This very deep, well drained soil is on the foot slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over fine textured glacial till derived dominantly from shaly rock. Slopes are complex. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,500 feet. The average annual precipitation is 25 to 32 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. The surface layer is yellowish brown loam about 5 inches thick. The upper 7 inches of the subsoil also is yellowish brown loam. The next 5 inches is light brownish gray gravelly loam. The next 13 inches is light brownish gray gravelly silty clay loam. The lower 15 inches is light brownish gray gravelly sandy clay loam. The substratum to a depth of 60 inches or more is light brownish gray gravelly loam.

Included in this unit are small areas of Smackout loam that has a slope of less than 20 percent or more than 40 percent, Ahren loam, Aits loam, and Waits loam. Also included are Belzar silt loam and Hartill silt loam on the upper parts of the slopes, Bonner silt loam and Martella silt loam on terrace remnants, Rock outcrop on knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Smackout soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir,

lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 80. The highest average growth rate for Douglas fir is 81 cubic feet per acre per year at age 97. Based on a 50-year site curve, the mean site index for western larch is 76. The highest average growth rate for western larch is 113 cubic feet per acre per year at age 70. The typical basal area of trees is about 70 percent of that in normal stands of Douglas fir and western larch. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, huckleberry, pachystima, willow, Oregongrape, thimbleberry, rose, ceanothus, alder, kinnikinnick, creambush oceanspray, and spirea. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, huckleberry, and rose, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting is the most effective seeding method.

The main limitations on homesites are the slope and the shrink-swell potential. Special designs for buildings may be needed to overcome the slope. Properly designing foundations and footings and diverting runoff away from buildings can help to prevent the structural damage caused by shrinking and swelling.

Septic tank absorption fields cannot function properly because of the slope and the moderately slow permeability. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is VIe, nonirrigated.

139-Smackout loam, 40 to 65 percent slopes. This very deep, well drained soil is on the back slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over fine textured glacial till derived dominantly from shaly rock. Slopes are complex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,500 feet. The average annual precipitation is 25 to 32 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. The surface layer is yellowish brown loam about 5 inches thick. The upper 7 inches of the subsoil also is yellowish brown loam. The next 5 inches is light brownish gray gravelly loam. The next 13 inches is light brownish gray gravelly silty clay loam. The lower 15 inches is light brownish gray gravelly sandy clay loam. The substratum to a depth of 60 inches or more is light brownish gray gravelly loam.

Included in this unit are small areas of Smackout loam that has a slope of less than 40 percent or more than 65 percent, Ahren loam, Aits loam, and Waits loam. Also included are Belzar silt loam and Hartill silt loam on the upper parts of the slopes, Martella silt loam on remnants of terrace escarpments, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to springs and seeps. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Smackout soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 80. The highest average growth rate for Douglas fir is 81 cubic feet per acre per year at age 97. Based on a 50-year site curve, the mean site index for western

larch is 76. The highest average growth rate for western larch is 113 cubic feet per acre per year at age 70. The typical basal area of trees is about 70 percent of that in normal stands of Douglas fir and western larch. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, huckleberry, pachystima, willow, Oregongrape, thimbleberry, rose, ceanothus, alder, kinnikinnick, creambush oceanspray, and spirea. A uniform distribution of grazing by domestic livestock is limited by the slope. Overgrazing causes the desirable plants, such as pinegrass, huckleberry, rose, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIe, nonirrigated.

140-Smackout Variant silt loam, 20 to 40 percent slopes. This very deep, well drained soil is on the foot slopes of mountains. It formed in a mantle of volcanic ash and loess over fine textured glacial till derived dominantly from shaly rock. Slopes are complex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,500 to 6,000 feet. The average annual precipitation is 35 to 45 inches, the average annual air temperature is about 39 degrees F, and the average growing season (at 28 degrees) is 60 to 80 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. The surface layer is brown silt loam about 10 inches thick. The subsoil is pale brown gravelly loam about 6 inches thick. The substratum to a depth of 60 inches or more is light brownish gray gravelly silty clay loam and gravelly sandy clay loam.

Included in this unit are small areas of Smackout Variant silt loam that has a slope of less than 20 percent or more than 40 percent, Manley silt loam, and Vassar silt loam. Also included are Huckleberry silt loam and Prouty extremely bouldery silt loam on the upper parts of the slopes, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Smackout Variant soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on this unit. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 76. The highest average growth rate for Douglas fir is 73 cubic feet per acre per year at age 99. Based on a 50-year site curve, the mean site index for western larch is 70. The highest average growth rate for western larch is 101 cubic feet per acre per year at age 70. Estimates of the site index and growth rate for subalpine fir and Engelmann spruce have not been made. The forest understory is mainly huckleberry, thimbleberry, common snowberry, longtube twinflower, kinnikinnick, pinegrass, pachystima, western brackenfern, rose, queencup beadlily, Oregongrape, and creambush oceanspray.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity.

When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

The capability subclass is Vle, nonirrigated.

141-Smackout Variant silt loam, 40 to 65 percent slopes. This very deep, well drained soil is on the back slopes of mountains. It formed in a mantle of volcanic ash and loess over fine textured glacial till derived dominantly from shaly rock. Slopes are complex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,500 to 6,000 feet. The average annual precipitation is 35 to 45 inches, the average annual air temperature is about 39 degrees F, and the average growing season (at 28 degrees) is 60 to 80 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. The surface layer is brown silt loam about 10 inches thick. The subsoil is pale brown gravelly loam about 6 inches thick. The substratum to a depth of 60 inches or more is light brownish gray gravelly silty clay loam and gravelly sandy clay loam.

Included in this unit are small areas of Smackout Variant silt loam that has a slope of less than 40 percent or more than 65 percent, Manley silt loam, and Vassar silt loam. Also included are Huckleberry silt loam and Prouty extremely bouldery silt loam on the upper parts of the slopes; Ahren loam, Belzar silt loam, and Smackout loam on the lower parts of the slopes; Rock outcrop on ridges and knobs; and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderately slow in this Smackout Variant soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, subalpine fir, and Engelmann spruce are the main woodland species on this unit. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, grand fir, western redcedar, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 76. The highest average growth rate for Douglas fir is 73 cubic feet per acre per year at age 99. Based on a 50-year site curve, the mean site index for western larch is 70. The highest average growth rate for western larch is 101 cubic feet per acre per year at age 70. Estimates of the site index and growth rate for subalpine fir and Engelmann spruce have not been made. The forest understory is mainly huckleberry, thimbleberry, common snowberry, longtube twinflower, kinnikinnick, pinegrass, pachystima, western brackenfern, rose, queencup beadlily, Oregongrape, and creambush oceanspray.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, subalpine fir, and Engelmann spruce occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

The capability subclass is VIle, nonirrigated.

142-Threemile silt loam, 0 to 25 percent slopes. This deep, well drained soil is on the toe slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over calcareous glacial till. Slopes are convex. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,400 to 4,000 feet. The average annual precipitation is 25 to 37 inches, the average annual air temperature is about

44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. The surface layer is yellowish brown silt loam about 4 inches thick. The upper 6 inches of the subsoil is yellowish brown loam. The lower 5 inches is brown gravelly loam. The upper 17 inches of the substratum is pale brown very gravelly loam. The lower 20 inches is light brownish gray extremely gravelly loam. Limestone is at a depth of about 52 inches. The depth to bedrock ranges from 40 to 60 inches.

Included in this unit are small areas of Threemile silt loam that has a slope of more than 25 percent, Ahren loam, Boundary silt loam, and Newbell silt loam. Also included are Anglen silt loam, Kaniksu sandy loam, and Kiehl gravelly silt loam on terrace remnants; Belzar silt loam on the upper parts of the slopes; Rock outcrop on knobs; and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Threemile soil. Available water capacity is low. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50year site curve, the mean site index for Douglas fir is 94. The highest average growth rate for Douglas fir is 114 cubic feet per acre per year at age 86. Based on a 50-year site curve, the mean site index for western larch is 79. The highest average growth rate for western larch is 120 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for lodgepole pine is 107. The highest average growth rate for lodgepole pine is 140 cubic feet per acre per year at age 100. The typical basal area of trees is about 40 percent of that in normal stands of Douglas fir, western larch, and lodgepole pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pachystima, Oregongrape, rose, ceanothus, thimbleberry, willow, grouse blueberry, rusty menziesia, common beargrass, creambush oceanspray, kinnikinnick, and Saskatoon serviceberry. Overgrazing causes the desirable plants, such as common beargrass, creambush oceanspray, Saskatoon serviceberry, and grouse blueberry, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated wheat, barley, and grass-legume hay. The main management concerns are the low available water capacity, the hazard of water erosion, and the slope. The crops that are tolerant of drought grow best. The amount of available moisture is not adequate for most other crops to grow well. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions or terraces may be needed to control erosion on cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

The main limitations on homesites are the slope and the depth to bedrock. Special designs for buildings may be needed to overcome the slope. The cuts needed to provide essentially level building sites can expose the bedrock.

Septic tank absorption fields cannot function properly because of the slope in some areas and the depth to bedrock. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is IIIe, nonirrigated.

143-Threemile silt loam, 25 to 40 percent slopes. This deep, well drained soil is on the foot slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over calcareous glacial till. Slopes are convex. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,400 to 4,000 feet. The average annual precipitation is 25 to 37 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. The surface layer is yellowish brown silt loam about 4 inches thick. The upper 6 inches of the subsoil is yellowish brown loam. The lower 5 inches is brown gravelly loam. The upper 17 inches of the substratum is pale brown very gravelly loam. The lower 20 inches is light brownish gray extremely gravelly loam. Limestone is at a depth of about 52 inches. The depth to bedrock ranges from 40 to 60 inches.

Included in this unit are small areas of Threemile silt loam that has a slope of less than 25 percent or more than 40 percent, Ahren loam, Boundary silt loam, and Newbell silt loam. Also included are Anglen silt loam, Kaniksu sandy loam, and Kiehl gravelly loam on terrace remnants; Belzar silt loam on the upper parts of the slopes; Rock outcrop on knobs; and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Threemile soil. Available water capacity is low. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 94. The highest average growth rate for Douglas fir is 114 cubic feet per acre per year at age 86. Based on a 50-year site curve, the mean site index for western larch is 79. The highest average growth rate for western larch is 120 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for lodgepole pine is 107. The highest average growth rate for lodgepole pine is 140 cubic feet per acre per year at age 100. The typical basal area of trees is about 40 percent of that in normal stands of Douglas fir, western larch, and lodgepole pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pachystima, Oregongrape, rose, ceanothus, thimbleberry, willow, grouse blueberry, rusty menziesia, common beargrass, creambush oceanspray, kinnikinnick, and Saskatoon serviceberry. Overgrazing causes the desirable plants, such as common beargrass, creambush oceanspray, Saskatoon serviceberry, and grouse blueberry, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting is the most effective seeding method.

The main limitations on homesites are the slope and the depth to bedrock. Special designs for buildings may be needed to overcome the slope. The cuts needed to provide essentially level building sites can expose the bedrock.

Septic tank absorption fields cannot function properly because of the slope and the depth to bedrock. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is VIe, nonirrigated.

144-Threemile silt loam, 40 to 65 percent slopes. This deep, well drained soil is on the back slopes of foothills and mountains. It formed in a mantle of

volcanic ash and loess over calcareous glacial till. Slopes are convex. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,400 to 4,000 feet. The average annual precipitation is 25 to 37 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. The surface layer is yellowish brown silt loam about 4 inches thick. The upper 6 inches of the subsoil is yellowish brown loam. The lower 5 inches is brown gravelly loam. The upper 17 inches of the substratum is pale brown very gravelly loam. The lower 20 inches is light brownish gray extremely gravelly loam. Limestone is at a depth of about 52 inches. The depth to bedrock ranges from 40 to 60 inches.

Included in this unit are small areas of Threemile silt loam that has a slope of less than 40 percent or more than 65 percent, Ahren loam, Boundary silt loam, and Newbell silt loam. Also included are Anglen silt loam, Kaniksu sandy loam, and Kiehl gravelly silt loam on terrace remnants; Belzar silt loam on the upper parts of the slopes; Rock outcrop on ridges and knobs; and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Threemile soil. Available water capacity is low. The effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, lodgepole pine, and western white pine. Based on a 50-year site curve, the mean site index for Douglas fir is 94. The highest average growth rate for Douglas fir is 114 cubic feet per acre per year at age 86. Based on a 50-year site curve, the mean site index for western larch is 79. The highest average growth rate for western larch is 120 cubic feet per acre per year at age 70. Based on a 100-year site curve, the mean site index for lodgepole pine is 107. The highest average growth rate for lodgepole pine is 140 cubic feet per acre per year at age 100. The typical basal area of trees is about 40 percent of that in normal stands of Douglas fir, western larch, and lodgepole pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western redcedar have not been made.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pachystima, Oregongrape, rose, ceanothus, thimbleberry, willow, grouse blueberry, rusty menziesia, common beargrass, creambush oceanspray, kinnikinnick, and Saskatoon serviceberry.

A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Overgrazing causes the desirable plants, such as common beargrass, creambush oceanspray, Saskatoon serviceberry, and grouse blueberry, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIe, nonirrigated.

145-Typic Xerorthents, 30 to 65 percent slopes.

These very deep, well drained soils are on terrace escarpments. They formed in glacial outwash of mixed mineralogy. The outwash has an admixture of volcanic ash and loess in the upper part. Slopes are convex. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

No single profile is typical of these soils. In one commonly observed in the survey area, however, the surface layer is dark grayish brown gravelly loam about 4 inches thick. The upper 8 inches of the underlying

material is yellowish brown very gravelly loam. The next 16 inches is yellowish brown extremely cobbly coarse sandy loam. The lower part to a depth of 60 inches or more is extremely cobbly loamy coarse sand. In some areas the surface layer is gravelly silt loam or gravelly sandy loam. In places the underlying material is loam, sandy loam, loamy sand, or sand in which the content of pebbles, cobbles, and stones is 35 to 70 percent.

Included in this unit are small areas of Bonner gravelly silt loam, Kiehl gravelly silt loam on terrace remnants, Dufort very stony silt loam, and Merkel stony sandy loam. Included areas make up about 20 percent of the unit.

Permeability is moderately rapid to a depth of 12 inches in the Typic Xerorthents and very rapid below that depth. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Ponderosa pine and Douglas fir are the main woodland species on this unit. Based on a 100-year site curve; the mean site index for ponderosa pine is 89. The highest average growth rate for ponderosa pine is 83 cubic feet per acre per year at age 40. Based on a 50-year site curve, the mean site index for Douglas fir is 72. The highest average growth rate for Douglas fir is 65 cubic feet per acre per year at age 104. The typical basal area of trees is about 55 percent of that in normal stands of ponderosa pine and Douglas fir. Per acre productivity is reduced accordingly.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soils less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. Occasional snowpack hinders the use of equipment in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine and Douglas fir occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. The low available water capacity can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly bluebunch wheatgrass, Idaho fescue, common snowberry, Oregongrape, needleandthread, spirea, strawberry, kinnikinnick, pachystima, creambush oceanspray, mallow ninebark, and pinegrass. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Idaho fescue, pinegrass, and creambush oceanspray, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIs, nonirrigated.

146-Uncas muck. This very deep, very poorly drained soil is on flood plains and in old lake basins. It formed in muck and alluvium derived dominantly from volcanic ash. Slope is 0 to 3 percent. The native vegetation is a few mixed deciduous trees, conifers, shrubs, forbs, and grasses. Elevation is 1,900 to 3,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 120 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface layer is muck about 7 inches thick. It is black when moist. The subsurface layer, the subsoil, and the substratum are mottled silt loam. The subsurface layer, which is about 7 inches thick, is very dark grayish brown when moist. The subsoil, which is about 7 inches thick, and the upper 11 inches of the substratum are light brownish gray when moist. The next 5 inches of the substratum is light olive brown when moist. The lower part to a depth of 60 inches or more is dark olive gray and grayish brown when moist.

Included in this unit are small areas of Blueslide silt loam, Hoodoo silt loam, and Kegel loam on flood plains and Pywell muck near the perimeter of lakes and in lake basins. Included areas make up about 20 percent of the unit.

Permeability is moderate in the Uncas soil. Available water capacity is very high. The effective rooting depth is limited by a seasonal high water table that is at a depth of 0.5 foot to 1.5 feet from December through April. The soil is subject to frequent, long periods of flooding from March through May. Runoff is very slow, and the hazard of water erosion is slight.

This unit is used for rangeland, nonirrigated crops, hay and pasture, recreation, watershed, and wildlife habitat.

This unit is suitable as rangeland. The native vegetation includes scattered conifers, such as western redcedar, and quaking aspen, black cottonwood, common snowberry, rose, black hawthorn, redosier dogwood, western meadowrue, false Solomons seal, spreading sweetroot, largeleaf avens, sweetscented bedstraw, and blue wildrye. Most areas have been cleared, however, and support tufted hairgrass, reed canarygrass, sedge, redtop, and cinquefoil. Overgrazing causes the desirable plants, such as tufted hairgrass, reed canarygrass, sedge, and redtop, to decrease in extent and the less desirable plants to increase. Wetness can limit access by livestock. Compaction occurs in areas that are grazed or browsed when the soil is wet. Seeding suitable plants in recently disturbed areas can help to provide desirable forage. Seedbed preparation and seeding are hindered by the seasonal wetness. A firm, well packed seedbed and a drill that has a depth regulator can improve the likelihood that seeding will be successful.

This unit is suited to nonirrigated oats and grass-legume hay. The main management concerns are the seasonal wetness and the hazard of flooding. Tile drains and open ditches have been used in most areas to remove excess surface and subsurface water where suitable outlets are available. Minimum tillage helps to prevent compaction. A tillage pan forms if the soil is tilled when wet. In some years spring planting is delayed because of wetness. The risk of flooding can be reduced by protective levees, dikes, and diversions. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture and maintain good tilth. A common crop rotation is 8 to 10 years of grass, such as timothy, and legume hay, such as alfalfa, and 2 years of grain.

This unit is well suited to hay and pasture. The main limitation is the seasonal wetness. The seasonal wetness limits the choice of suitable plants and the period of cutting or grazing and increases the risk of winterkill. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. Periodic mowing and clipping help to maintain uniform plant growth and discourage selective grazing. Proper grazing practices, weed control, and applications of fertilizer are needed to ensure the maximum quality of forage. In some years irrigation is needed.

The capability subclass is Vw, nonirrigated.

147-Uncas Variant muck. This very deep, very poorly drained soil is on the flood plains and in old lake basins. It formed in alluvium derived dominantly from volcanic ash. Slope is 0 to 3 percent. The native vegetation is mainly shrubs, forbs, and grasses. Elevation is 3,000 to 5,000 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is about 41 degrees F, and the average growing season (at 28 degrees) is 70 to 90 days.

Typically, the surface layer is muck about 6 inches thick. It is black when moist. The subsurface layer, which is about 8 inches thick, and the upper 37 inches of the underlying material are mottled silt loam. The subsurface layer is dark grayish brown when moist. The upper 6 inches of the underlying material is brown when moist. The next 31 inches is grayish brown when moist. The lower part to a depth of 60 inches or more is mottled sandy loam that is gray when moist.

Included in this unit are small areas of Borosaprists in depressions and Kegel loam on narrow flood plains along drainageways. Included areas make up about 15 percent of the unit.

Permeability is moderate in the Uncas Variant soil. Available water capacity is very high. The effective rooting depth is limited by a seasonal high water table that is above the surface or within a depth of 0.5 foot from March through May. Runoff is very slow, and the hazard of water erosion is slight.

This unit is used for rangeland, recreation, watershed, and wildlife habitat.

This unit is suitable as rangeland. The vegetation is mainly sedge, redtop, tufted hairgrass, and rush. Overgrazing causes the desirable plants, such as sedge, redtop, and tufted hairgrass, to decrease in extent and the less desirable plants to increase. Wetness can limit access by livestock. Compaction occurs in areas that are grazed or browsed when the soil is wet. Grazing should be delayed until the soil is sufficiently dry and is firm enough to withstand trampling by livestock. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. A firm, well packed seedbed and a drill that has a depth regulator can improve the likelihood that seeding will be successful.

The capability subclass is VIw, nonirrigated.

148-Usk loam, 0 to 20 percent slopes. This moderately deep, well drained soil is on the toe slopes and ridgetops of foothills and mountains. It formed in residuum and colluvium derived dominantly from granitic rock. The residuum and colluvium have an admixture of volcanic ash and loess. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 1 ,800 to 3,000 feet. The average annual precipitation is 24 to 30 inches, the average annual air temperature is about 46 degrees F, the

average growing season (at 28 degrees) is 110 to 130 days, and the average frost-free period (at 32 degrees) is 85 to 115 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is grayish brown loam about 9 inches thick. The upper part of the subsoil is pale brown gravelly loam about 10 inches thick. The lower part is light yellowish brown gravelly sandy loam about 7 inches thick. The substratum also is light yellowish brown gravelly sandy loam. It is about 6 inches thick. Highly weathered granite is at a depth of about 32 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Usk loam that has a slope of more than 20 percent, soils that are similar to Usk loam but are deep or very deep, and Skanid loam. Also included are Moscow silt loam and Moso silt loam in small areas on north and east aspects, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Usk soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate:

This unit is used for grazable woodland, nonirrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Ponderosa pine and Douglas fir are the main woodland species on this unit. Among the trees of limited extent are western larch and lodgepole pine. Based on a 100-year site curve, the mean site index for ponderosa pine is 102. The highest average growth rate for ponderosa pine is 106 cubic feet per acre per year at age 40. Based on a 50-year site curve, the estimated mean site index for Douglas fir is 90. The estimated highest average growth rate for Douglas fir is 104 cubic feet per acre per year at age 90. The typical basal area of trees is about 60 percent of that in normal stands of ponderosa pine and Douglas fir. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine and Douglas fir occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings.

The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are frequently subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly common snowberry, pinegrass, redstem ceanothus, mallow ninebark, bluebunch wheatgrass, Idaho fescue, rose, creambush oceanspray, arrowleaf balsamroot, willow, lupine, Saskatoon serviceberry, dogbane, Oregongrape, and pachystima. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Idaho fescue, pinegrass, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated wheat, barley, and grass-legume hay. The main management concerns are the low available water capacity, the hazard of water erosion, and the slope. The crops that are tolerant of drought grow best. The amount of available moisture is not adequate for most other crops to grow well. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions or terraces may be needed to control erosion on cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

The main limitations on homesites are the slope, the instability of cutbanks, and the depth to bedrock. Special designs for buildings may be needed to overcome the slope. The sides of shallow excavations can cave in unless they are supported by special retainer walls. The cuts needed to provide essentially level building sites can expose the bedrock.

Septic tank absorption fields cannot function properly because of the slope in some areas and the depth to

bedrock. The effluent can surface in downslope areas and create a health hazard. The capability subclass is IVe, nonirrigated.

149-Usk loam, 20 to 40 percent slopes. This moderately deep, well drained soil is on the foot slopes and ridgetops of foothills and mountains. It formed in residuum and colluvium derived dominantly from granitic rock. The residuum and colluvium have an admixture of volcanic ash and loess. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is 24 to 30 inches, the average annual air temperature is about 46 degrees F, the average growing season (at 28 degrees) is 110 to 130 days, and the average frost-free period (at 32 degrees) is 85 to 115 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is grayish brown loam about 9 inches thick. The upper part of the subsoil is pale brown gravelly loam about 10 inches thick. The lower part is light yellowish brown gravelly sandy loam about 7 inches thick. The substratum also is light yellowish brown gravelly sandy loam. It is about 6 inches thick. Highly weathered granite is at a depth of about 32 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Usk loam that has a slope of less than 20 percent or more than 40 percent, soils that are similar to Usk loam but are deep or very deep, and Skanid loam. Also included are Moscow silt loam and Moso silt loam in small areas on north and east aspects, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Usk soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Ponderosa pine and Douglas fir are the main woodland species on this unit. Among the trees of limited extent are western larch and lodgepole pine. Based on a 100-year site curve, the mean site index for ponderosa pine is 102. The highest average growth rate for ponderosa pine is 106 cubic feet per acre per year at age 40. Based on a 50-year site curve, the estimated mean site index for Douglas fir is 90. The estimated highest average growth rate for Douglas fir is 104 cubic feet per acre per year at age 90. The typical basal area of trees is about 60 percent of that in normal stands of ponderosa pine and Douglas fir. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine and Douglas fir occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly common snowberry, pinegrass, redstem ceanothus, mallow ninebark, bluebunch wheatgrass, Idaho fescue, rose, creambush oceanspray, arrowleaf balsamroot, willow, lupine, Saskatoon serviceberry, dogbane, Oregongrape, and pachystima. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Idaho fescue, pinegrass, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting is the most effective seeding method.

The main limitations on homesites are the slope, the instability of cutbanks, and the depth to bedrock. Special designs for buildings may be needed to overcome the slope. The sides of shallow excavations

can cave in unless they are supported by special retainer walls. The cuts needed to provide essentially level building sites can expose the bedrock.

Septic tank absorption fields cannot function properly because of the slope and the depth to bedrock. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is VIe, nonirrigated.

150-Usk loam, 40 to 65 percent slopes. This moderately deep, well drained soil is on the back slopes and ridgetops of foothills and mountains. It formed in residuum and colluvium derived dominantly from granitic rock. The residuum and colluvium have an admixture of volcanic ash and loess. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is 24 to 30 inches, the average annual air temperature is about 46 degrees F, the average growing season (at 28 degrees) is 110 to 130 days, and the average frost-free period (at 32 degrees) is 85 to 115 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is grayish brown loam about 9 inches thick. The upper part of the subsoil is pale brown gravelly loam about 10 inches thick. The lower part is light yellowish brown gravelly sandy loam about 7 inches thick. The substratum also is light yellowish brown gravelly sandy loam. It is about 6 inches thick. Highly weathered granite is at a depth of about 32 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Usk loam that has a slope of less than 40 percent or more than 65 percent, soils that are similar to Usk loam but are deep or very deep, and Skanid loam. Also included are Moscow silt loam and Moso silt loam in small areas on north and east aspects, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Usk soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Ponderosa pine and Douglas fir are the main woodland species on this unit. Among the trees of limited extent are western larch and lodgepole pine. Based on a 100-year site curve, the mean site index for ponderosa pine is 102. The highest average growth rate for ponderosa pine is 106 cubic feet per acre per year at age 40. Based on a 50-year site curve, the estimated mean site index for Douglas fir is 90. The estimated highest average growth rate for Douglas fir is 104 cubic feet per acre per year at age 90. The typical basal area of trees is about 60 percent of that in normal stands of ponderosa pine and Douglas fir. Per acre productivity is reduced accordingly.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine and Douglas fir occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly common snowberry, pinegrass, redstem ceanothus, mallow ninebark, bluebunch wheatgrass, Idaho fescue, rose, creambush oceanspray, arrowleaf balsamroot, willow, lupine, Saskatoon serviceberry, dogbane, Oregongrape, and pachystima. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Idaho fescue, pinegrass. creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIe, nonirrigated.

151-Usk stony loam, 0 to 40 percent slopes. This moderately deep, well drained soil is on the toe slopes, foot slopes, and ridgetops of foothills and mountains. It formed in residuum and colluvium derived dominantly from granitic rock. The residuum and colluvium have an admixture of volcanic ash and loess. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is 24 to 30 inches, the average annual air temperature is about 46 degrees F, and the average growing season (at 28 degrees) is 110 to 130 days.

Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is grayish brown stony loam about 9 inches thick. The upper part of the subsoil is pale brown gravelly loam about 10 inches thick. The lower part is light yellowish brown gravelly sandy loam about 7 inches thick. The substratum also is light yellowish brown gravelly sandy loam. It is about 6 inches thick. Highly weathered granite is at a depth of about 32 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Usk stony loam that has a slope of more than 40 percent, soils that are similar to Usk stony loam but are deep or very deep, and Skanid loam. Also included are Moscow silt loam and Moso silt loam in small areas on north and east aspects, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Usk soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Ponderosa pine and Douglas fir are the main woodland species on this unit. Among the trees of limited extent are western larch and lodgepole pine. Based on a 100-year site curve, the mean site index for ponderosa pine is 102. The highest average growth rate for ponderosa pine is 106 cubic feet per acre per year at age 40. Based on a 50-year site curve, the estimated mean site index for Douglas fir is 90. The estimated highest average growth rate for Douglas fir is 104 cubic feet per acre per year at age 90. The typical basal area of trees is about 60 percent of that in normal stands of ponderosa pine and Douglas fir. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the stones on the surface, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The stones on the surface can hinder harvesting. Also, falling timber can break on the stones.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine and Douglas fir occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly common snowberry, pinegrass, redstem ceanothus, mallow ninebark, bluebunch wheatgrass, Idaho fescue, rose, creambush oceanspray, arrowleaf balsamroot, willow, lupine, Saskatoon serviceberry, dogbane, Oregongrape, and pachystima. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Idaho fescue, pinegrass, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the stones on the surface and by the slope. Broadcasting is the most effective seeding method.

The main limitations on homesites are the slope, the instability of cutbanks, and the depth to bedrock. Special designs for buildings may be needed to overcome the slope. The stones can interfere with excavation. The sides of shallow excavations can cave in unless they are supported by special retainer walls. The cuts needed to provide essentially level building sites can expose the bedrock.

Septic tank absorption fields cannot function properly

because of the slope in some areas and the depth to bedrock. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is VIs, nonirrigated.

152-Usk-Rock outcrop complex, 0 to 40 percent slopes. This map unit is on the toe slopes, foot slopes, and ridgetops of foothills and mountains. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is 24 to 30 inches, the average annual air temperature is about 46 degrees F, and the average growing season (at 28 degrees) is 110 to 130 days.

This unit is about 65 percent Usk stony loam, 0 to 40 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Usk stony loam that has a slope of more than 40 percent, soils that are similar to Usk stony loam but are deep or very deep, and Skanid loam. Also included are Moscow silt loam and Moso silt loam in small areas on north and east aspects, very stony and very shallow soils near the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

This Usk soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from granitic rock. The residuum and colluvium have an admixture of volcanic ash and loess. Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is grayish brown stony loam about 9 inches thick. The upper part of the subsoil is pale brown gravelly loam about 10 inches thick. The lower part is light yellowish brown gravelly sandy loam about 7 inches thick. The substratum also is light yellowish brown gravelly sandy loam. It is about 6 inches thick. Highly weathered granite is at a depth of about 32 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Usk soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Rock outcrop consists mainly of exposed granitic rock.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Ponderosa pine and Douglas fir are the main woodland species on the Usk soil. Among the trees of limited extent are western larch and lodgepole pine.

Based on a 100-year site curve, the mean site index for ponderosa pine is 102. The highest average growth rate for ponderosa pine is 106 cubic feet per acre per year at age 40. Based on a 50-year site curve, the estimated mean site index for Douglas fir is 90. The estimated highest average growth rate for Douglas fir is 104 cubic feet per acre per year at age 90. The typical basal area of trees is about 60 percent of that in normal stands of ponderosa pine and Douglas fir, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the Rock outcrop, the stones on the surface, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop and the stones on the surface can hinder harvesting. Also, falling timber can break on the Rock outcrop and the stones.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine and Douglas fir occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly common snowberry, pinegrass, redstem ceanothus, mallow ninebark, bluebunch wheatgrass, Idaho fescue, rose, creambush oceanspray, arrowleaf balsamroot, willow, lupine, Saskatoon serviceberry, dogbane, Oregongrape, and pachystima. Overgrazing causes the desirable plants,

such as bluebunch wheatgrass, Idaho fescue, pinegrass, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the Rock outcrop, the stones on the surface, and the slope. Broadcasting is the most effective seeding method.

The Usk soil is in capability subclass VIs, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

153-Usk-Rock outcrop complex, 40 to 65 percent slopes. This map unit is on the back slopes of foothills and mountains. Slopes are convex and generally have south and west aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 1,800 to 3,000 feet. The average annual precipitation is 24 to 30 inches, the average annual air temperature is about 46 degrees F, and the average growing season (at 28 degrees) is 110 to 130 days.

This unit is about 65 percent Usk stony loam, 40 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Usk stony loam that has a slope of less than 40 percent or more than 65 percent, soils that are similar to Usk stony loam but are deep or very deep, and Skanid loam. Also included are Moscow silt loam and Moso silt loam in small areas on north and east aspects, very stony and very shallow soils near the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

This Usk soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from granitic rock. The residuum and colluvium have an admixture of volcanic ash and loess. Typically, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is grayish brown stony loam about 9 inches thick. The upper part of the subsoil is pale brown gravelly loam about 10 inches thick. The lower part is light yellowish brown gravelly sandy loam about 7 inches thick. The substratum also is light yellowish brown gravelly sandy loam. It is about 6 inches thick. Highly weathered granite is at a depth of about 32 inches. The depth to weathered bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Usk Soil. Available water capacity is low. The effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed granitic rock.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Ponderosa pine and Douglas fir are the main woodland species on the Usk soil. Among the trees of limited extent are western larch and lodgepole pine. Based on a 100-year site curve, the mean site index for ponderosa pine is 102. The highest average growth rate for ponderosa pine is 106 cubic feet per acre per year at age 40. Based on a 50-year site curve, the estimated mean site index for Douglas fir is 90. The estimated highest average growth rate for Douglas fir is 104 cubic feet per acre per year at age 90. The typical basal areas of trees on this Usk soil is about 60 percent of that in normal stands of ponderosa pine and Douglas fir, and the Rock outcrop is not productive. Per acre productivity is reduced accordingly.

The main limitations affecting timber harvesting are the Rock outcrop, stones on the surface, and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop and the stones on the surface can hinder harvesting. Also, falling timber can break on the Rock outcrop and the stones.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by ponderosa pine and Douglas fir occurs periodically. Reforestation can be accomplished by planting ponderosa pine or Douglas fir seedlings. The limited available water capacity and droughtiness on south and west aspects can reduce the seedling survival rate. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because the rooting depth is restricted by the bedrock, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The

forest understory is mainly common snowberry, pinegrass, redstem ceanothus, mallow ninebark, bluebunch wheatgrass, Idaho fescue, rose, creambush oceanspray, arrowleaf balsamroot, willow, lupine, Saskatoon serviceberry, dogbane, Oregongrape, and pachystima. A uniform distribution of grazing by domestic livestock is unlikely because of the slope and the Rock outcrop. Overgrazing causes the desirable plants, such as bluebunch wheatgrass, Idaho fescue, pinegrass, creambush oceanspray, and mallow ninebark, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope, the stones on the surface, and the Rock outcrop. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Usk soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

154-Vassar silt loam, 30 to 65 percent slopes. This deep, well drained soil is on the back slopes of mountains. It formed in a thick mantle of volcanic ash and loess over residuum and colluvium derived dominantly from granitic or metasedimentary rock. Slopes are complex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 6,000 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 70 to 90 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. The surface layer is brown silt loam about 16 inches thick. The subsoil is pale brown silt loam about 8 inches thick. The upper 19 inches of the substratum is very pale brown coarse sandy loam. The lower part is light gray loamy coarse sand about 9 inches thick. Fractured granitic rock is at a depth of about 52 inches. The depth to weathered bedrock ranges from 40 to 60 inches.

Included in this unit are small areas of Vassar silt loam that has a slope of less than 30 percent or more than 65 percent, Vassar silt loam that has a shaly substratum, Huckleberry silt loam, and Manley silt loam. Also included are Buhrig stony loam on the upper back slopes, Brickel stony loam on the upper parts of south- and west-facing back slopes and ridgetops, Rock outcrop on ridges and knobs, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 15 percent of the unit.

Permeability is moderate in this Vassar soil. Available water capacity also is moderate. The effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, grand fir, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are subalpine fir, western hemlock, western larch, lodgepole pine, western white pine, and Engelmann spruce. Based on a 50-year site curve, the mean site index for Douglas fir is 86. The highest average growth rate for Douglas fir is 95 cubic feet per acre per year at age 93. Based on a 50-year site curve, the estimated mean site index for grand fir is 60. The estimated highest average growth rate for grand fir is 76 cubic feet per acre per year at age 120. Estimates of the site index and growth rate for western redcedar and subalpine fir have not been made. The forest understory is mainly pachystima, American trailplant, baldhip rose, huckleberry, goldthread, piper anemone, fairybells, starry false Solomons seal, bunchberry dogwood, western brackenfern, common princes pine, and sedge.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, grand fir, western redcedar, and subalpine fir occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and prevent the establishment of natural and planted reforestation species.

The capability subclass is VIIe, nonirrigated.

155-Vassar silt loam, shaly substratum, 30 to 65 percent slopes. This deep, well drained soil is on the back slopes of mountains. It formed in a thick mantle of volcanic ash and loess over residuum and colluvium

derived dominantly from metasedimentary rock, including sandstone, schist, and gneiss. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 3,000 to 6,000 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 70 to 90 days.

Typically, the surface is covered with a mat of organic material about 2 inches thick. The surface layer is dark brown silt loam about 7 inches thick. The upper part of the subsoil is dark yellowish brown silt loam about 8 inches thick. The lower part is dark yellowish brown loam about 5 inches thick. The upper 8 inches of the substratum is yellowish brown gravelly loam. The lower 15 inches is yellowish brown very gravelly sandy loam. Fractured mica schist is at a depth of about 43 inches. The depth to weathered bedrock ranges from 40 to 60 inches.

Included in this unit are small areas of Vassar silt loam that has a shaly substratum and has a slope of less than 30 percent or more than 65 percent, Vassar silt loam underlain by fractured granite bedrock, Huckleberry silt loam, and Manley silt loam. Also included are Buhrig stony loam on the upper back slopes, Brickel stony loam on the upper parts of south- and west-facing back slopes and ridgetops, Rock outcrop on knobs and ridges, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Vassar soil. Available water capacity also is moderate. The effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of water erosion is very severe. Soil slumping occurs throughout this unit.

This unit is used for woodland, recreation, watershed, and wildlife habitat.

Douglas fir, grand fir, western redcedar, and subalpine fir are the main woodland species on this unit. Among the trees of limited extent are western hemlock, western larch, lodgepole pine, western white pine, and Engelmann spruce. Based on a 50-year site curve, the mean site index for Douglas fir is 86. The highest average growth rate for Douglas fir is 95 cubic feet per acre per year at age 93. Based on a 50-year site curve, the estimated mean site index for grand fir is 60. The estimated highest average growth rate for grand fir is 76 cubic feet per acre per year at age 170. Estimates of the site index and growth rate for western redcedar and subalpine fir have not been made. The forest understory is mainly pachystima, American trailplant, baldhip rose, huckleberry, goldthread, piper anemone, fairybells, starry false Solomons seal, bunchberry dogwood, western brackenfern, common princes pine, and sedge.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, grand fir, western redcedar, and subalpine fir occurs periodically. Reforestation can be accomplished by planting Douglas fir, Engelmann spruce, western larch, or western white pine seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and prevent the establishment of natural and planted reforestation species.

The capability subclass is VIIe, nonirrigated.

156-Waits loam, 0 to 15 percent slopes. This very deep, well drained soil is on the toe slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over calcareous glacial till. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. When mixed to a depth of about 7 inches, the surface layer is light yellowish brown loam. The upper 6 inches of the subsoil is light yellowish brown silt loam. The lower 11 inches is light yellowish brown gravelly loam. The substratum to a depth of 60 inches or more is light gray gravelly loam.

Included in this unit are small areas of Waits loam that has a slope of more than 15 percent, Ahren loam, Aits loam, and Newbell silt loam. Also included are Belzar silt loam on the upper parts of the slopes, Bonner silt loam on terrace remnants, Inkler gravelly silt loam on south- and west-facing slopes, and poorly

drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Waits soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for grazable woodland, nonirrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, and lodgepole pine. Based on a 50-year site curve, the mean site index for Douglas fir is 81, The highest average growth rate for Douglas fir is 83 cubic feet per acre per year at age 96. Estimates of the site index and growth rate for western larch and western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, Saskatoon serviceberry, kinnikinnick, creambush oceanspray, ceanothus, Oregongrape, strawberry, white spirea, rose, common snowberry, thimbleberry, pachystima, and western brackenfern. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, and Saskatoon serviceberry, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated wheat, barley, and grass-legume hay. The main management concerns are the hazard of water erosion and the slope. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming, stripcropping, and diversions or terraces may be needed to control erosion on cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 or 3 years of small grain.

The main limitation on homesites is the slope. Special designs for buildings may be needed to overcome the slope.

The main limitation on sites for septic tank absorption fields is the slope. The absorption lines should be installed on the contour.

The capability subclass is IIIe, nonirrigated.

157-Waits loam, 15 to 25 percent slopes. This very deep, well drained soil is on the toe slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over calcareous glacial till. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. When mixed to a depth of about 7 inches, the surface layer is light yellowish brown loam. The upper 6 inches of the subsoil is light yellowish brown silt loam. The lower 11 inches is light yellowish brown gravelly loam. The substratum to a depth of 60 inches or more is light gray gravelly loam.

Included in this unit are small areas of Waits loam that has a slope of less than 15 percent or more than 25 percent, Ahren loam, Aits loam, and Newbell silt loam. Also included are Belzar silt loam on the upper parts of the slopes, Bonner silt loam on terrace remnants, Inkler gravelly silt loam on south- and west-facing slopes, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Waits soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for grazable woodland, nonirrigated crops, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, and lodgepole pine. Based on a 50-year site curve, the mean site index for Douglas fir is 81. The highest average growth rate for Douglas fir is 83 cubic feet per acre per year at age 96. Estimates of the site index and growth rate for western larch and western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, Saskatoon serviceberry, kinnikinnick, creambush oceanspray, ceanothus, Oregongrape, strawberry, white spirea, rose, common snowberry, thimbleberry, pachystima, and western brackenfern. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, and Saskatoon serviceberry, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

This unit is suited to nonirrigated wheat, barley, and grass-legume hay. The main management concerns are the hazard of water erosion and the slope. Minimizing tillage, seeding early in fall, chiseling in fall, and farming across the slope help to control sheet and rill erosion. Tillage operations that leave adequate amounts of crop residue on the surface help to conserve moisture, maintain good tilth, and control erosion. Divided-slope farming and stripcropping may be needed to control erosion on cropland. Where runoff concentrates in drainageways, erosion can be controlled by double seeding of fall grain or by grassed waterways. A common crop rotation is 4 to 8 years of grass-legume hay, such as alfalfa, and 2 years of small grain.

The main limitation on homesites is the slope. Special designs for buildings may be needed to overcome the slope.

Septic tank absorption fields cannot function properly because of the slope. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is lVe, nonirrigated.

158-Waits loam, 25 to 40 percent slopes. This very deep, well drained soil is on the foot slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over calcareous glacial till. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. When mixed to a depth of about 7 inches, the surface layer is light yellowish brown loam. The upper 6 inches of the subsoil is light yellowish brown silt loam. The lower 11 inches is light yellowish brown gravelly loam. The substratum to a depth of 60 inches or more is light gray gravelly loam.

Included in this unit are small areas of Waits loam that has a slope of less than 25 percent or more than 40 percent, Ahren loam, Aits loam, and Newbell silt loam. Also included are Belzar silt loam on the upper parts of the slopes, Bonner silt loam on terrace remnants, Inkler gravelly silt loam on south- and west-facing slopes, poorly drained soils in draws and adjacent to seeps and springs, and Rock outcrop on knobs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Waits soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for grazable woodland, homesite development, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, and lodgepole pine. Based on a 50-year site curve, the mean site index for Douglas fir is 81. The highest average growth rate for Douglas fir is 83 cubic feet per

acre per year at age 96. Estimates of the site index and growth rate for western larch and western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, and the slope, which hinders the use of skidding equipment. Using standard wheeled or tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, Saskatoon serviceberry, kinnikinnick, creambush oceanspray, ceanothus, Oregongrape, strawberry, white spirea, rose, common snowberry, thimbleberry, pachystima, and western brackenfern. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, and Saskatoon serviceberry, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting is the most effective seeding method.

The main limitation on homesites is the slope. Special designs for buildings may be needed to overcome the slope.

Septic tank absorption fields cannot function properly because of the slope. The effluent can surface in downslope areas and create a health hazard.

The capability subclass is Vle, nonirrigated.

159-Waits loam, 40 to 65 percent slopes. This very deep, well drained soil is on the back slopes of foothills and mountains. It formed in a mantle of volcanic ash and loess over calcareous glacial till. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. When mixed to a depth of about 7 inches, the surface layer is light yellowish brown loam. The upper 6 inches of the subsoil is light yellowish brown silt loam. The lower 11 inches is light yellowish brown gravelly loam. The substratum to a depth of 60 inches or more is light gray gravelly loam.

Included in this unit are small areas of Waits loam that has a slope of less than 40 percent or more than 65 percent, Ahren loam, Aits loam, and Newbell silt loam. Also included are Belzar silt loam on the upper parts of the slopes, Bonner silt loam on terrace remnants, Inkler gravelly silt loam on south- and west-facing slopes, poorly drained soils in draws and adjacent to seeps and springs, and Rock outcrop on ridges and knobs. Included areas make up about 20 percent of the unit.

Permeability is moderate in this Waits soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on this unit. Among the trees of limited extent are western hemlock, grand fir, and lodgepole pine. Based on a 50-year site curve, the mean site index for Douglas fir is 81. The highest average growth rate for Douglas fir is 83 cubic feet per acre per year at age 96. Estimates of the site index and growth rate for western larch and western redcedar have not been made.

The main limitation affecting timber harvesting is the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep

areas that have been cut and filled reduces the hazard of sheet and rill erosion.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, Saskatoon serviceberry, kinnikinnick, creambush oceanspray, ceanothus, Oregongrape, strawberry, white spirea, rose, common snowberry, thimbleberry, pachystima, and western brackenfern. A uniform distribution of grazing by domestic livestock is unlikely because of the slope. Overgrazing causes the desirable plants, such as pinegrass, Saskatoon serviceberry, creambush oceanspray, and rose, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope. Broadcasting with aerial or hand equipment is the most effective seeding method.

The capability subclass is VIIe, nonirrigated.

160-Waits-Rock outcrop complex, 25 to 40 percent slopes. This map unit is on the foot slopes of foothills and mountains. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

This unit is about 70 percent Waits loam, 25 to 40 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Waits loam that has a slope of less than 25 percent or more than 40 percent, Ahren loam, Aits stony loam, and Newbell stony silt loam. Also included are Belzar silt loam on the upper parts of the slopes, Bonner silt loam and Martella silt loam on terrace remnants, Inkler gravelly silt loam on south- and west-facing slopes, very stony and very shallow soils near the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 10 percent of the unit.

This Waits soil is very deep and well drained. It formed in a mantle of volcanic ash and loess over calcareous glacial till. Typically, the surface is covered with a mat of organic material about $1^{1}/2$ inches thick. When mixed to a depth of about 7 inches, the surface layer is light yellowish brown loam. The upper 6 inches of the subsoil is light yellowish brown silt loam. The lower 11 inches is light yellowish brown gravelly loam. The substratum to a depth of 60 inches or more is light gray gravelly loam.

Permeability is moderate in the Waits soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

The Rock outcrop consists mainly of exposed dolomite, limestone, and calcareous shale.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on the Waits soil. Among the trees of limited extent are western hemlock, grand fir, and lodgepole pine. Based on a 50-year site curve, the mean site index for Douglas fir is 81. The highest average growth rate for Douglas fir is 83 cubic feet per acre per year at age 96. The Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western larch and western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring, snowpack in winter, the Rock outcrop, and the slope, which hinders the use of skidding equipment. Using standard wheeled and tracked equipment when the soil is moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Low-pressure ground equipment damages the soil less severely than conventional equipment and thus helps to maintain productivity. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep skid trails, firebreaks, and other disturbed areas are subject to rifling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western

larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, Saskatoon serviceberry, kinnikinnick, creambush oceanspray, ceanothus, Oregongrape, strawberry, white spirea, rose, common snowberry, thimbleberry, pachystima, and western brackenfern. Overgrazing causes the desirable plants, such as pinegrass, creambush oceanspray, and Saskatoon serviceberry, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the Rock outcrop and the slope. Broadcasting is the most effective seeding method.

The Waits soil is in capability subclass Vle, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

161-Waits-Rock outcrop complex, 40 to 65 percent slopes. This map unit is on the back slopes of foothills and mountains. Slopes are convex and generally have north and east aspects. The native vegetation is mainly conifers, shrubs, forbs, and grasses. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

This unit is about 70 percent Waits loam, 40 to 65 percent slopes, and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Waits loam that has a slope of less than 40 percent or more than 65 percent, Ahren loam, Aits stony loam, and Newbell stony silt loam. Also included are Belzar silt loam on the upper parts of the slopes, Bonner silt loam and Martella silt loam on terrace remnants, Inkler gravelly silt loam on south- and west-facing slopes, very stony and very shallow soils near the Rock outcrop, and poorly drained soils in draws and adjacent to seeps and springs. Included areas make up about 10 percent of the unit.

This Waits soil is very deep and well drained. It formed in a mantle of volcanic ash and loess over calcareous glacial till. Typically, the surface is covered with a mat of organic material about 1 1/2 inches thick. When mixed to a depth of about 7 inches, the surface layer is light yellowish brown loam. The upper 6 inches of the subsoil is light yellowish brown silt loam. The lower 11 inches is light yellowish brown gravelly loam. The substratum to a depth of 60 inches or more is light gray gravelly loam.

Permeability is moderate in the Waits soil. Available water capacity is high. The effective rooting depth is 60 inches or more. Runoff is very rapid, and the hazard of water erosion is very severe.

The Rock outcrop consists mainly of exposed dolomite, limestone, and calcareous shale.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, western larch, and western redcedar are the main woodland species on the Waits soil. Among the trees of limited extent are western hemlock, grand fir, and lodgepole pine. Based on a 50-year site curve, the mean site index for Douglas fir is 81. The highest average growth rate for Douglas fir is 83 cubic feet per acre per year at age 96. The Rock outcrop is not productive. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for western larch and western redcedar have not been made.

The main limitations affecting timber harvesting are the Rock outcrop and the slope, which restricts the use of skidding equipment. Cable yarding systems are safer. They damage the soil less severely than conventional equipment and thus help to maintain productivity. Constructing roads on midslopes requires extensive cutting and filling, which can remove land from production. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Occasional snowpack hinders the use of equipment in winter. The Rock outcrop can hinder harvesting. Also, falling timber can break on the Rock outcrop.

Steep yarding paths, skid trails, firebreaks, and other disturbed areas are subject to rilling and gullying unless adequate water bars are provided or a protective plant cover is established. Establishing a plant cover in steep areas that have been cut and filled reduces the hazard of sheet and rill erosion. Because of large areas of Rock outcrop, yarding paths and skid trails tend to converge. As a result, the degree of compaction is increased.

If the stand includes seed trees, natural reforestation of cutover areas by Douglas fir, western larch, and western redcedar occurs periodically. Reforestation can be accomplished by planting Douglas fir or western larch seedlings. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. Because of the Rock outcrop, the results of reforestation are not evenly distributed.

This unit is suited to grazing and browsing. The forest understory is mainly pinegrass, Saskatoon

serviceberry, kinnikinnick, creambush oceanspray, ceanothus, Oregongrape, strawberry, white spirea, rose, common snowberry, thimbleberry, pachystima, and western brackenfern. A uniform distribution of grazing by domestic livestock is unlikely because of the slope and the Rock outcrop. Overgrazing causes the desirable plants, such as pinegrass, Saskatoon serviceberry, creambush oceanspray, and rose, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Seedbed preparation and seeding are hindered by the slope and the Rock outcrop. Broadcasting with aerial or hand equipment is the most effective seeding method.

The Waits soil is in capability subclass VIIe, nonirrigated. The Rock outcrop is in capability subclass VIIIs.

162-Xerochrepts-Aquic Xerofluvents complex, 0 to 5 percent slopes. This map unit is on planar slopes adjacent to the major drainageways. The native vegetation is mainly conifers, forbs, shrubs, and grasses. Elevation is 2,600 to 4,200 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

This unit is about 60 percent Xerochrepts and 30 percent Aquic Xerofluvents. The components of this unit occur as areas so intricately intermingled that mapping them separately is not practical at the scale used.

Included in this unit are small areas of Xerochrepts and Aquic Xerofluvents that have a slope of more than 5 percent, Anglen silt loam, and Martella silt loam. Included areas make up about 10 percent of the unit.

Xerochrepts are very deep and well drained. They formed in a thin mantle of volcanic ash and loess over glacial drift of mixed mineralogy. No single profile is typical of these soils. In one commonly observed in the survey area, however, the surface is covered with a mat of organic material about 1 inch thick. When mixed to a depth of about 10 inches, the surface layer is pale brown gravelly silt loam. The subsoil is light gray very gravelly sandy loam about 10 inches thick. The substratum to a depth of 60 inches or more is light gray extremely gravelly loamy sand. The texture, color, and thickness of the layers of these soils vary widely from one area to another and occasionally within short distances. The subsoil is silt loam, loam, sandy loam, or the gravelly or very gravelly analogs of those textures. The substratum is sandy loam, loamy sand, sand, or the gravelly, very gravelly, or extremely gravelly analogs of those textures.

Permeability is moderately rapid to a depth of about 20 inches in the Xerochrepts and very rapid below that depth. Available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

Aquic Xerofluvents are very deep and somewhat poorly drained. They formed in a mantle of volcanic ash and loess over alluvium and glacial outwash of mixed mineralogy. No single profile is typical of these soils. In one commonly observed in the survey area, however, the surface is covered with a mat of organic material about 1 inch thick. The surface layer is pale brown silt loam about 20 inches thick. The underlying material to a depth of 60 inches or more is stratified, light gray, mottled very gravelly sandy loam to extremely gravelly loamy sand. The texture, color, and thickness of the layers of these soils vary widely from one area to another and occasionally within short distances. The surface layer is silt loam, loam, sandy loam, or the gravelly analogs of those textures. The underlying material is stratified sandy loam, loamy sand, sand, or the gravelly, very gravelly, cobbly, or very cobbly analogs of those textures.

Permeability is moderate to a depth of about 20 inches in the Aquic Xerofluvents and very rapid below that depth. Available water capacity is low. The effective rooting depth is limited by a seasonal high water table at a depth of 2 to 4 feet from February through May. Runoff is slow, and the hazard of water erosion is slight. The soils are subject to occasional, brief periods of flooding from February through May.

This unit is used for grazable woodland, recreation, watershed, and wildlife habitat.

Douglas fir, ponderosa pine, and western larch are the main woodland species on the Xerochrepts. Among the trees of limited extent are western hemlock, grand fir, and western white pine. Based on a 50-year site curve, the estimated mean site index for Douglas fir is 65. The estimated highest average growth rate for Douglas fir is 52 cubic feet per acre per year at age 106. Based on a 50-year site curve, the estimated mean site index for western larch is 61. The estimated highest average growth rate for western larch is 81 cubic feet per acre per year at age 70. Based on a 50-year site curve, the mean site index for western white pine is 70. The highest average growth rate for western white pine is 135 cubic feet per acre per year at age 105. The typical basal area of trees is about 60 percent of that in normal stands of Douglas fir, western larch, and western white pine. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for ponderosa pine have not been made.

Engelmann spruce, western redcedar, western white pine, and Douglas fir are the main woodland species on

the Aquic Xerofluvents. Among the trees of limited extent are grand fir, lodgepole pine, western larch, and black cottonwood. Based on a 50-year site curve, the estimated mean site index for western white pine is 65. The estimated highest average growth rate for western white pine is 127 cubic feet per acre per year at age 105. Based on a 50-year site curve, the estimated mean site index for Douglas fir is 85. The highest average growth rate for Douglas fir is 90 cubic feet per acre per year at age 94. Based on a 50-year site curve, the mean site index for western larch is 51. The highest average growth rate for western larch is 65 cubic feet per acre per year at age 70. The typical basal area of trees is about 60 percent of that in normal stands of western white pine, Douglas fir, and western larch. Per acre productivity is reduced accordingly. Estimates of the site index and growth rate for Engelmann spruce and western redcedar have not been made.

The main limitations affecting timber harvesting are soil wetness in spring and snowpack in winter. Using standard wheeled and tracked equipment when the soils are moist causes compaction and the formation of ruts. Displacement of the surface layer occurs most readily when the soils are dry. Puddling can occur when the soils are wet. Low-pressure ground equipment damages the soils less severely than conventional equipment and thus helps to maintain productivity. If roads are constructed on this unit, additional rock is needed to improve the ability of the Aquic Xerofluvents to support equipment. When wet, unsurfaced roads and skid trails are soft and slippery and can be impassable. Snowpack hinders the use of equipment and limits access in winter.

If the stand includes seed trees, natural reforestation of cutover areas occurs periodically. The chief reforestation species are Douglas fir, ponderosa pine, and western larch on the Xerochrepts and Engelmann spruce, western redcedar, western white pine, and Douglas fir on the Aquic Xerofluvents. Reforestation can be accomplished by planting Douglas fir, ponderosa pine, or western larch seedlings on the Xerochrepts and Engelmann spruce seedlings on the Aquic Xerofluvents. When openings are made in the canopy, brushy plants that are not controlled invade and delay the establishment of natural and planted reforestation species. The flooding on the Aquic Xerofluvents hinders root respiration and thus results in a low seedling survival rate. Because the rooting depth is restricted by the seasonal high water table in the Aquic Xerofluvents, the trees are occasionally subject to windthrow during wet periods when winds are strong.

This unit is suited to grazing and browsing. The forest understory is mainly huckleberry, pinegrass, Oregongrape, pachystima, elk sedge, common snowberry, ceanothus, strawberry, redosier dogwood, thimbleberry, queencup beadlily, and longtube twinflower on the Xerochrepts and sedge, common snowberry, spirea, thimbleberry, Oregongrape, willow, elderberry, Saskatoon serviceberry, western brackenfern, rush, and hawthorn on the Aquic Xerofluvents. Overgrazing causes the desirable plants, such as pinegrass, sedge, redosier dogwood, and huckleberry on the Xerochrepts and sedge, elderberry, and Saskatoon serviceberry on the Aquic Xerofluvents, to decrease in extent and the less desirable plants to increase. Seeding suitable plants in recently disturbed areas can help to control erosion and provide desirable forage. Broadcasting is the most effective seeding method.

The Xerochrepts are in capability subclass IVs, nonirrigated. The Aquic Xerofluvents are in capability subclass IVw, nonirrigated.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The system of land capability classification used by the Soil Conservation Service is explained, and the estimated yields of the main crops are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1987, Pend Oreille County had 227 farms, which had a total area of 62.578 acres. Of this total, 22,923 acres was cropland, most of which was used for timothy hay or grass hay (20).

Grass hay, barley, oats, and wheat are the main crops in the survey area. Most of the crops are used as feed for dairy cows and beef cattle, which are of primary importance to the local economy. Small grain commonly is grown for 1 or 2 years as a cleanup crop prior to reestablishment of alfalfa and grass.

The acreage used for cultivated crops is limited by a short growing season, by soil properties that restrict the suitability for crops and the management options, and by low precipitation during the growing season. Most of the level to moderately sloping soils on foothills, terraces, and bottom land are suited to small grain, hay, and pasture. Perennial hay and pasture stands occasionally are damaged by frost and other winter conditions.

Seasonal wetness or droughtiness commonly limits crop production. A moisture deficient period usually occurs during the growing season, from mid-June through mid-October. Moisture is normally replenished during fall and winter.

Irrigation is practical in the survey area only where water is available in a sufficient quantity to justify the cost of equipment and operations. The potential for the development of irrigation from ground water sources is limited throughout the survey area. The expansion of irrigation is prevented in many areas where claims for water rights are in excess of available water supplies in the streams and lakes. The Cusick Flats area along the Pend Oreille River has potential for additional irrigation development. Bonner, Clayton, Scotia, Cusick, Dufort, Eloika, Kaniksu, Rathdrum, Martella, and Anglen soils

are suited to irrigated crops.

The Calispell diking and pumping system, which is in the Cusick area, has increased the potential for improving drainage and growing conditions on 3,000 acres of cropland. This area is used mainly for timothy hay, grass, and clover for pasture. The Locke Watershed Project, which was completed in 1971, has improved 1,100 acres of cropland.

Blueslide, Cusick, Kegel, Pywell, Sacheen Variant, Uncas Variant, and Uncas soils have a high water table during winter and spring. A perched water table and moderately slow or slow permeability in the subsoil may restrict rooting depth in the moderately well drained Anglen, Dalkena, and Martella soils. Tile drainage or open ditches can help to overcome the wetness on sites where adequate outlets are available.

Most of the cultivated soils in the survey area require applications of fertilizer for maximum production of grain and forage crops. Nitrogen and sulfur provide the best results. Legumes respond well to applications of boron in areas where this nutrient is deficient. The kind and amount of fertilizer should be based on the results of soil tests, on the needs of crops, and on expected yields.

The surface layer of most of the soils in the survey area that are used for crop production is silt loam, loam, sandy loam, or fine sandy loam. The structure of this layer is easily destroyed. The soils commonly have a low organic matter content. Organic matter is an important source of plant nutrients, especially nitrogen, phosphorus, and sulfur. It also is essential in maintaining tilth. Regular additions of crop residue and animal manure improve soil structure, maintain the organic matter content, and minimize crusting.

Erosion depletes soil productivity. It removes nutrients and organic matter and reduces the available water capacity. It is not a serious problem in the survey area, except where the steeper areas, especially of Anglen, Martella, and Dalkena soils, are tilled without appropriate erosion-control measures. Soil eroded from farmland can pollute streams and lakes with sediments and nutrients.

Including legumes and grass forage crops in the cropping system helps to control erosion, provides nitrogen for plants, and improves tilth. Terraces and diversions can help to control runoff and erosion, especially on very deep, well drained soils that have uniform, regular slopes, by intercepting excessive surface runoff. Stripcropping and divided-slope farming also can help to control runoff from long, sloping fields. Cross-slope farming helps to control erosion and increases the rate of water infiltration. A system of conservation tillage, such as minimum tillage, helps to maintain filth and control erosion. Maintaining a protective cover of plants or leaving crop residue on the surface is especially important during fall and winter.

Wind erosion is a hazard on sandy soils and in areas where the surface is disturbed by tillage. Maintaining a protective cover of plants or crop residue and seeding in early fall can help to control wind erosion on Clayton, Dalkena, Kaniksu, Orwig, Rathdrum, Sacheen, and Scotia soils. As an emergency measure, tillage can be used to roughen the surface.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (16). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils generally are grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII, The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within, one class. They are designated by adding a small letter, *e, w, s*, or *c*, to the class numeral, for example, Ile. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States,. shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation,

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in table 5.

Woodland Management and Productivity

Prepared by Branislav Lalich and Lyn Townsend, foresters, Soil Conservation Service.

Of the 53 soil series and soil variants mapped in the survey area, 36 support prime woodland, which is forest land that has a mean annual increment of 85 cubic feet or more per acre per year. About 92 percent of the survey area is forested.

In 1983, the survey area had three sawmills, one chip mill, and one post and pole operation. Most of the trees that are harvested in the survey area are transported to Idaho for processing.

Wildfire and archaic logging practices have been instrumental in the maintenance and spread of large acreages of pioneer tree species, such as lodgepole pine and western larch. If modern silvicultural methods and harvesting techniques were applied, the more desirable tree species could dominate the forests of the survey area. The climate, soils, topography, geology, and parent seed sources are suitable.

Problems are created by insects and disease periodically but usually do not reach epidemic proportions because of their cyclical nature. Maintaining healthy stands through proper management helps to control the problems. Shoestring root rot, laminated root rot, red ring rot, white pine blister rust, and casebearer are the most common diseases.

Shoestring root rot, *Armillaria mellea,* is a fungus that is widespread as a saprophyte. It is parasitic only on trees that are declining in vigor. It affects white pine, Douglas fir, western redcedar, western hemlock, spruces, and firs. Laminated root rot, *Poria weirii,* is most damaging to immature conifers, especially western redcedar. Red ring rot, *Fomes pini,* occurs in practically all species of conifers in the Pacific Northwest. Losses caused by it exceed those caused by any other decay fungus. White pine blister rust, *Cronartium ribicola,* infects white pine. Casebearer, *Colleophera laricella,* attacks western larch. It impairs growth by defoliation but is rarely fatal.

Insects that periodically cause problems in the survey area are pine engraver beetle, *Ips pini;* red turpentine beetle, *Dendroctonus valens;* mountain pine beetle, *Dendroctonus ponderosae;* and Douglas fir beetle, *Dendroctonus psuedotsugae.* They kill many trees. They are endemic to the area and become noticeable when conditions for population buildup are suitable. Occurrences of damaging infestations of pine engraver beetle and mountain pine beetle have been linked to stress factors, such as below normal rainfall, snowpack, and poor management of slash when pine trees are harvested during summer.

Dwarf mistletoe, *Arceuthobium spp,* is a parasitic plant on lodgepole pine, Douglas fir, ponderosa pine, and western larch in the survey area.

The Pacific maritime climate largely determines the type of forest within the survey area. Because of westerly winds, high pressure systems over the Pacific, and the jet stream passing over the area, the high peaks receive as much as 90 inches of precipitation annually while the valleys receive as little as 21 inches (12). The Pend Oreille River flows north from Newport, effectively bisecting the part of the Selkirk Mountain Range that is in the survey area. On the eastern side of the river, the highest elevation is Gypsy Peak, which has an elevation of 7,309 feet. On the west side of the river is Linton Mountain, which has an elevation of 6,215 feet.

The survey area can be divided into five "Soil-Woodland" zones. These zones are based on elevation, forest overstory species, climate, and soil characteristics. Although the species for which a zone is named predominate, associated species grow in nearly pure stands. Boundary lines between zones do not indicate precise divisions because changes in the dominant species occur gradually. Soil characteristics, climate, geology, and topography combine to create conditions suitable for particular plant communities. These communities are dominant in a given zone. They thrive well outside their respective zones, however, because of cold-air drainages, microclimates, temperature inversions, slope, and aspect (3, 7).

The *ponderosa pine zone* ranges in elevation from 1,800 to 3,500 feet. Generally, ponderosa pine is not a climax species in this zone but has been maintained because of fires or management practices.

The *Douglas fir zone* ranges in elevation from 1,800 to 5,000 feet. Seral tree species in this zone are western larch, lodgepole pine, paper birch, and trembling aspen.

The *western hemlock-western redcedar zone* ranges in elevation from 1,800 to 5,000 feet. Grand fir is among the climax species in this zone. Seral tree species are Douglas fir, lodgepole pine, western white pine, western larch, and ponderosa pine.

The *subalpine-Engelmann spruce zone* ranges in elevation from 5,500 to 7,000 feet. White bark pine grows at the upper elevations in this zone. Seral tree species are western larch, Engelmann spruce, lodgepole pine, and Douglas fir.

The *black cottonwood zone* is generally in alluvial and colluvial areas where the soils have a fluctuating water table.

Soil surveys are becoming increasingly more important to forest managers as they seek ways of increasing the productivity of their forested lands. Plants respond better to applications of fertilizer on some soils than on others. Some soils are susceptible to landslides and erosion after road building and harvesting, and others require special harvesting methods and reforestation efforts. Under the heading "Detailed Soil Map Units," the descriptions of the suitable map units provide information concerning forest productivity, the limitations that affect harvesting and producing timber, and the common forest understory plants. The methods and procedures used to develop this information are included in the "National Forestry Manual" (19) and in the "Forest Land Grading Procedures Handbook" (21).

Table 7 summarizes the forestry information given in the map unit descriptions and can serve as a quick reference for important forestry interpretations. The ordination (woodland suitability) symbol for each map unit shown in the table is given. All soils having the same ordination symbol require the same general kinds of forest management and have about the same potential productivity.

The *ordination symbol* is based on a uniform system that indicates the potential productivity of an individual soil and the principal hazards or limitations of that soil (19). The first element of the ordination symbol is a number that denotes the potential productivity in terms of cubic meters of wood per hectare per year for the indicator tree species, which is the species listed first in the map unit descriptions and in the *Common trees* column in table 7. The potential productivity is based on the site index and the corresponding culmination of the mean annual increment (CMAI). For example, the number 1 indicates a potential production of 1 cubic meter of wood per hectare (14.3 cubic feet per acre) per year, and 10 indicates a potential production of 10 cubic meters of wood per hectare (143 cubic feet per acre) per year. If trees on a soil have a basal area that is typically below what is considered normal, a proportionate reduction was made in determining the first element of the symbol. In the detailed map unit descriptions, the "highest average growth rate" is

equivalent to the CMAI in cubic feet per acre per year.

The second element of the symbol, a letter, indicates the major kind of soil characteristic that limits tree growth or management. The letter R indicates steep slopes; X indicates stoniness or rockiness; W, excess water, either seasonally or year-round, in or on the soil; T, toxic substances within the root zone; D, restricted rooting depth; C, clayey soils; S, sandy soils; and F, a high content of fragments. The letter A indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the letter denoting the most limiting characteristic is used according to the following priority: R, X, W, T, D, C, S, and F.

In table 7, the soils are rated for a number of factors to be considered in management. Ratings of *slight, moderate,* and *severe* indicate the degree of major soil limitations. For each moderate or severe rating, a sentence in the applicable map unit description explains the soil factor or factors that are the basis of that rating.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that the use of equipment is not normally restricted to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation because of soil wetness, a fluctuating water table, or some other factor; and *severe* indicates a seasonal limitation, a need for special equipment (such as a cable yarding system), or a hazard in the use of equipment.

Slope and wetness are the main factors that cause equipment limitations in the survey area. As slope gradient and length increase, using wheeled equipment becomes more difficult. On the steeper slopes, tracked equipment must be used. On the steepest slopes, even tracked equipment cannot be operated safely and more sophisticated systems must be used. Wetness, especially in combination with a fine texture, can so severely limit the use of equipment that harvesting is practical only during dry summer months.

Ratings of *seedling mortality* indicate the probability of the death of naturally occurring or planted tree seedlings, as influenced by soil type and topographic conditions. Plant competition is not considered in the ratings. The ratings apply to healthy seedlings from good stock that are properly planted or naturally established seedlings that germinate during a period of insufficient soil moisture. A rating of *slight* indicates that no significant mortality is expected under usual conditions; *moderate* indicates that some mortality can be expected and that extra precautions are advisable; and *severe* indicates that mortality will be high and extra precautions are essential for successful reforestation. Seedling mortality can be caused by wetness; by droughtiness in the surface layer, especially on south- or southwest-facing slopes; or by the position of the soil on a ridgetop. Larger than usual planting stock, special site preparation, a surface drainage system, or reinforcement planting can help to reduce the seedling mortality rate.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees normally are not blown down by the wind. Strong winds may break the trees but do not uproot them. A rating of *moderate* indicates that an occasional tree may be blown down during periods of excessive wetness and moderate or strong winds, and a rating of *severe* indicates that many trees can be blown down during these periods. A restricted rooting depth caused by a high water table, underlying bedrock, or an impervious layer and poor anchoring of roots because of a loose surface layer and subsoil are responsible for windthrow. Moderate and severe ratings indicate the need for extra care in thinning the edges of woodland stands, a plan for the periodic removal of windthrown trees, and an adequate road and trail system to allow for this removal.

Ratings of *plant competition* indicate the likelihood of the invasion or growth of undesirable brushy plants when openings are made in the tree canopy. A rating of *slight* indicates that unwanted brushy plants are not likely to delay natural reforestation and that planted seedlings can survive and grow well without undue competition; *moderate* indicates that competition will delay natural or artificial reforestation; and *severe* indicates that competition can be expected to prevent natural or artificial reforestation unless special measures are applied. Favorable climate and soil characteristics account for plant competition. In many areas the key to predicating brush competition is the quantity of and proximity to seed sources of undesirable plants or the quantity of unwanted brush rootstocks that can resprout after harvest activities. Moderate and severe ratings indicate the need for careful and thorough cleanup after a harvest in preparation for reforestation and the possible need for mechanical or chemical treatment to retard the growth of brush and allow seedlings to become established.

The *potential productivity* of common trees on a soil is expressed as a *site index* and *a productivity* class.

The site index is determined by measuring the height and age of selected trees within stands of a given species. It applies to fully stocked, even-aged, unmanaged stands. The highest timber yields, usually expressed in board feet or cubic feet per acre, can be expected from map units with the highest site index values. These values can be converted into estimated yields at various ages by carefully using appropriate yield publications. The procedures and techniques for determining the site index are described in the appropriate site index publications (8, *9, 13). Common trees* are listed in the same order as that of their general occurrence observed on the soil map unit.

Trees to plant are those that are used for reforestation or that, under suitable conditions, are allowed to regenerate naturally. The species listed in table 7 are suited to the soils and can be used for commercial wood production. The desired product, topographic position, and personal preference are among the many factors that can influence the choice of trees suitable for reforestation.

Woodland Understory Vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants. If well managed, some woodland can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees in the canopy, the density of the canopy, and the depth and condition of the litter. The density of the canopy determines the amount of light that understory plants receive.

Table 8 shows, for each soil suitable for woodland, the potential for producing understory vegetation. The *total production* of understory vegetation includes the herbaceous plants and the leaves, twigs, and fruit of woody plants up to a height of 4.5 feet. It is expressed in pounds per acre of air-dry vegetation in favorable, normal, and unfavorable years. In a favorable year, soil moisture is above average during the optimal part of the growing season; in a normal year, soil moisture is average; and in an unfavorable year, it is below average.

Table 8 also lists the common names of the *characteristic vegetation* on each soil and the percentage *composition,* by air-dry weight, of each kind of plant. The table shows the kind and percentage of understory plants expected under a canopy density that is most nearly typical of woodland in which the production of wood crops is highest.

Native Grazing Resources

By Lucius W. Tilden, area range conservationist, Soil Conservation Service.

Approximately 29,000 acres in the survey area is grazed by livestock during part of the year. Much of the forage grazed by livestock is produced on 14,000 acres of private meadows and improved pastures (20).

According to a recent census, the survey area has 3,510 beef cattle, 272 dairy cows, 201 sheep, and 464 horses. A majority of these livestock graze on the meadows and forest land. Some graze on improved pastures. Beef cattle in the survey area represent only about 0.3 percent of the total for Washington (20).

Cow-calf or cow-yearling operations. are the most common systems of beef production. The main areas used for the production of beef cattle are along the southern border of the county, on the Cusick Flats, and in the valley of the Pend Oreille River.

Supplemental feed is required for livestock from about mid-October into April. Calving normally occurs in February and March. Summer grazing is primarily on land owned by the Forest Service, the Washington State Department of Natural Resources, and large timber companies. A small amount of other land is used for grazing.

Grazable woodland is scattered throughout the survey area. It is mainly on foothills in the western part of the survey area, along the Pend Oreille River, and in areas near Le Clerc Creek and Sullivan Lake where land ownership is divided between the Forest Service and private timber companies in a checkerboard pattern. Some grazable woodland is on the slopes of high mountains in National forest land, mainly on west, southwest, and south aspects. The grazing land in the survey area ranges in elevation from 2,000 to 6,500 feet.

Soil properties, climate, and topography interact to produce a particular kind and amount of potential, or climax, vegetation on a soil. The potential vegetation is the native plant community that is best suited to the particular conditions and is stable and in balance with the environment. The potential plant community or communities for particular soil series have been identified and are recorded at the field office of the Soil Conservation Service in Newport, Washington.

Soil properties that affect moisture supply and plant nutrients have the greatest influence on the suitability of a soil for forage species and on the productivity of the plants. Other soil properties, such as reaction, salt content, and a seasonal high water table, also are important. The kind, density, and seral stage of overstory trees significantly affect the composition and

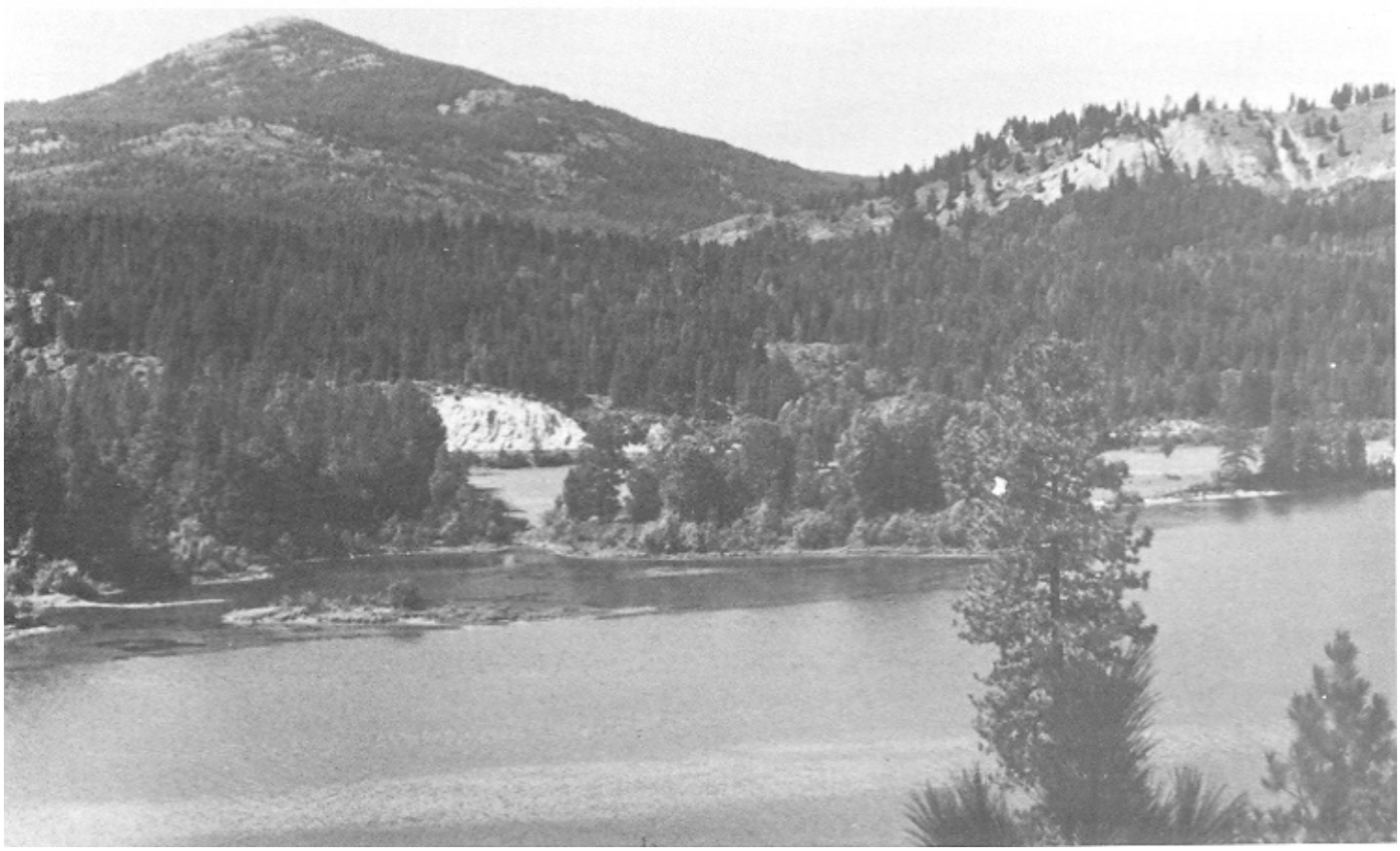

Figure 6.-An area of the Pend Oreille River. The rivers and lakes in the survey area provide opportunities for recreation. Granite Mountain is in the background.

productivity of the understory. Management of grazing land requires a knowledge of the soils, the potential plant community, and the types of changes that occur in the composition of understory plants because of outside disturbances, such as logging, fire, and grazing.

The objective in managing grazing land is a plant community that is about the same in kind and amount as the potential natural plant community. Achieving this objective generally results in the optimum production of vegetation, conservation of water, and control of erosion. A plant community that is somewhat below the potential, however, may better meet the objectives of the land users, provide suitable wildlife habitat, and protect soil and water resources.

If productivity is to be maintained or improved, the amount of herbage removed by grazing should be controlled. A planned grazing system involves using two or more grazing units that are periodically rested in a planned sequence over a period of years.

In areas where seeding is needed or desirable, seeding in a well prepared seedbed with a drill is generally the most effective method to establish desirable vegetation.

In areas of woodland, brush and a lack of roads or trails may limit access by livestock. Properly locating salt, watering facilities, and fences can improve the distribution of livestock. Thinning stands, logging, or controlled burning reduces the density of the canopy and improves the growing conditions for grasses, forbs, and shrubs. Seeding suitable plants along skid trails, on landings, and in other disturbed areas can help to control erosion and provide desirable forage. The grazing resource in areas of woodland is commonly transitory. How long it lasts depends on the kinds and composition of overstory and understory plant species, on soil characteristics, and on climatic factors.

Recreation

The forests, lakes, streams, and valleys in Pend Oreille County Area provide many recreational opportunities (fig. 6). The Washington State Department

of Game provides boating access to the Pend Oreille River and many lakes. The U.S. Army Corp of Engineers provides recreational areas along the Pend Oreille River. The Washington State Department of Natural Resources, state parks, and the Forest Service provide campgrounds throughout the survey area. .

Typical winter activities include downhill skiing, cross-country skiing, snowmobiling, and sledding. Many roadways are reserved for snowmobiles and are delineated on maps, which are made available by local agencies and businesses.

Spring and summer activities include hiking, camping, berry picking, fishing, swimming, and boating. Waterskiing and fishing are popular at many lakes. Most of the land owned by the timber companies is open to the public. During the fire season, however, some areas are closed.

A major activity in the fall is big game hunting. White-tailed deer, mule deer, bear, and elk are hunted throughout the survey area. Waterfowl, such as ducks and geese, are hunted on or near lakes and streams.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties generally are favorable and that limitations *are minor and easily overcome. Moderate* means that limitations can be overcome or alleviated by planning, *design, or special maintenance. Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for dwellings without basements and for local roads and streets in table 11 and interpretations for septic tank absorption fields in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

Ivan Lines, biologist, Soil Conservation Service, helped prepare this section.

Only a small percentage of the total acreage in Pend Oreille County Area is managed specifically for fish and wildlife. Consequently, the kinds and amounts of fish and wildlife are largely determined by the quantity and quality of habitat in areas that are used as rangeland, woodland, or cropland.

The survey area is dominated by coniferous forests. These forests provide habitat for a variety of woodland wildlife, such as black bear, elk, mule deer, white-tailed deer, bobcat, snowshoe hare, blue grouse, and ruffed grouse. A small population of woodland caribou inhabits some of the more remote areas. A small population of moose has been expanding its range during the past several years.

Most of the forests in the survey area have been logged at least once. Many have been logged in recent years. Numerous openings have been created in the

forests by logging, by burning, or by clearing the land for agriculture. Consequently, the forests have a variety of coniferous and deciduous trees in various successional stages. The openings generally improve wildlife habitat because of the interspersion of herbaceous or shrubby plant communities with the trees.

The forested soils in general soil map units 1 to 6 provide habitat for woodland wildlife, such as deer, bear, elk, and grouse. The small, scattered, irregularly shaped areas where timber has been harvested provide valuable habitat between woodland and open areas. For several years following logging, openings support wildlife habitat elements, such as grasses, forbs, and shrubs. Woodland wildlife habitat can be created or improved throughout the survey area by maintaining snags; maintaining stands of trees of mixed age and species, including deciduous trees; protecting riparian vegetation; and preventing the sedimentation of streams. Important food sources for many kinds of wildlife result from seeding logged areas, burned areas, roadsides, and critically eroded areas with herbaceous plants, particularly legumes.

Fire or mechanical treatment can set back forest succession and create an interspersion between forest and herbaceous, shrubby vegetation. Grazing by livestock should be managed so that riparian zones are protected. The needs of wildlife for food and cover should be considered when grazing management is planned.

Much of the land in general soil map units 5 to 7 has been developed for irrigated or nonirrigated crops or for grazing. The openings caused by land clearing and agricultural development have improved the habitat for some kinds of woodland wildlife and have created habitat for openland wildlife, such as Hungarian partridge, California quail, mourning dove, and meadowlark.

Conservation practices that improve the habitat for openland wildlife include planting cover crops or maintaining abundant crop residue on the surface during the winter; leaving uncultivated strips of vegetation along shorelines and streambanks; properly managing grazing in pastured areas, especially along streams and in wetlands; controlling runoff from animal-holding areas; and carefully applying pesticides. In many areas the habitat can be improved by establishing year-round patches or rows of woody cover. Leaving small patches of grain throughout the winter improves the habitat for woodland, openland, and wetland wildlife.

In the survey area several hundred lakes, ponds, and wetlands, the Pend Oreille and Little Spokane Rivers, and numerous smaller creeks provide habitat for aquatic and semiaquatic species, including rainbow trout, cutthroat trout, brown trout, and brook trout, Kohanee salmon, largemouth and smallmouth bass, beaver, waterfowl, herons, bald eagle, and osprey. Terrestrial species, such as moose and raccoon, also are highly dependent on the aquatic habitat.

The soils in general soil map unit 7 are along streams and in poorly drained depressions and wetlands. They provide habitat for wetland wildlife, provide protective cover for openland wildlife, and are an integral component of stream habitat for fish and small mammals. Riparian plant communities provide diverse habitat for a large number of fish and wildlife species.

Conservation practices that improve the habitat for wetland wildlife include protecting riparian vegetation from cultivation, fire, herbicides, and excessive grazing and protecting wetlands from filling, drainage, and excessive sedimentation. Riparian plant communities can be maintained or improved by planting herbaceous and woody species. Grain crops that are planted adjacent to wetlands or that are seasonally inundated by water provide extremely valuable habitat for waterfowl. Many wetlands and wet depressions can be improved by diking, by installing water-control structures, and by constructing ponds.

Woodland, openland, and wetland habitat in the survey area support several hundred species of birds and mammals. Most of the birds are migratory. They breed and then rear their young in the survey area. They spend winter in warmer climates to the south or at lower elevations. Many species of birds and mammals help to control insects and rodents that can damage farm crops, orchards, forest trees, and gardens. Most species benefit from soil and water conservation practices that maintain a plant cover and prevent water pollution.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining

the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are poplar, aspen, cottonwood, cherry, apple, hawthorn, dogwood, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are chokecherry, serviceberry, and snowberry.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are Douglas fir, ponderosa pine, lodgepole pine, and western larch.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are redosier dogwood, bitterbrush, snowberry, serviceberry, ninebark, and oceanspray.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, cattail, reed canarygrass, rushes, and sedges (5).

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include California quail, mourning dove, pheasant, meadowlark, savannah sparrow, and cottontail.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants, or both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, blue grouse, woodpeckers, squirrels, porcupine, white-tailed deer, and black bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building Site Development, Sanitary Facilities, Construction Materials, and Water Management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreation uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the "Glossary."

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement

of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills generally are limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments.
The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is

disposed of by burying it in soil. There are two types of landfill-trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as *a probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading.

Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel, or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated fair are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and depth to the water table is less than 1 foot. These soils have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of

grain sizes is given in the table on engineering index properties.

A soil rated as *a probable* source has a layer of clean sand or gravel or a layer of sand or gravel that is as much as 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an *improbable* source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils generally is preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even more than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to

flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features listed in tables are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution and plasticity.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the system adopted by the American Association of State Highway and Transportation Officials (1) and the Unified soil classification system (2). Both systems are described in the "PCA Soil Primer" (10).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution. liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. Values are not given for soils that formed in material having a high content of volcanic ash. The textures specified for these soils are apparent field textures. Because of the influence of the ash, a complete clay dispersion is not obtained in the laboratory and the reported clay values are low. The measured physical and chemical properties for these soils indicate a much higher clay content than is reported by the laboratories.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Commonly, special design is needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low,* a change of less than 3 percent; *moderate, 3* to 6 percent; and *high,* more than 6 percent. *Very high,* greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to

predict the average rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (as much as 4 percent) and on soil structure and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.00 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion.

Erosion factor T is an estimate of the maximum average rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms (17).

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but is possible under unusual weather conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months.

The information on flooding is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and level of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table-that is, *perched* or *apparent,* and the months of the year that the water table usually is highest. A water table that is seasonally high for less than 1 month is not indicated in the table.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower water table by a dry zone.

Only saturated zones within a depth of about 6 feet

are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Table 18 gives estimates of various soil features that affect engineering uses.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (18). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in so!. An example is Inceptisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ochrept *(Ochr,* meaning pale, plus *ept,* from Inceptisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Xerochrepts *(Xer,* meaning dry, plus *ochrept,* the suborder of the Inceptisols that has an ochric epipedon).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. An example is Vitrandic Xerochrepts.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, thickness of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy, mixed, mesic Vitrandic Xerochrepts.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (15). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (18). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Ahren Series

The Ahren series consists of very deep, well drained soils on foothills and mountains. These soils formed in a mantle of volcanic ash and loess and in calcareous, fine textured glacial till derived dominantly from shaly rock and limestone. Slope is 2 to 65 percent. Elevation

is 1,800 to 3,800 feet. The average annual precipitation is 27 to 32 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are fine-loamy, mixed, frigid Andic Xerochrepts.

Typical pedon of Ahren loam, 20 to 40 percent slopes, about 0.75 mile south and 2 miles west of Metaline Falls, 2,000 feet north and 1 ,000 feet east of the southwest corner of sec. 30, T. 38 N., R. 43 E.

Oe-1 inch to 0; partially decomposed needles, leaves, twigs, bark, and cones; abrupt smooth boundary.

A-0 to 3 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine, common medium, and few coarse roots; many fine pores; about 5 percent pebbles; neutral; clear wavy boundary.

Bw-3 to 10 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common fine and medium roots; many fine and common very fine pores; about 10 percent pebbles; neutral; clear wavy boundary.

2BC1-10 to 24 inches; light gray (2.5Y 7/2) gravelly silty clay loam, grayish brown (2.5Y 5/2) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; few fine, medium, and coarse roots; common fine pores; about 20 percent pebbles; mildly alkaline; clear wavy boundary.

2BC2-24 to 37 inches; light gray (2.5Y 7/2) gravelly silty clay loam, grayish brown (2.5Y 5/2) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; few medium and coarse roots; few medium pores; about 30 percent pebbles; mildly alkaline; clear wavy boundary.

2C-37 to 60 inches; light gray (2.5Y 7/2) very gravelly silty clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, firm, sticky and slightly plastic; few coarse roots; few fine pores; about 40 percent pebbles; strongly effervescent; moderately alkaline.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. The control section has 25 to 35 percent clay and 5 to 35 percent rock fragments. The mean annual soil temperature at a depth of about 20 inches ranges from 45 to 47 degrees F. A thin layer of light colored volcanic ash is at the surface in some pedons.

The A horizon, if it occurs, has chroma of 2 or 3 when moist. The texture is loam or silt loam.

The Bw horizon has hue of 10YR or 7.5YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. The texture is loam or silt loam. Reaction is neutral or mildly alkaline.

The 2BC horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 when dry and 3 to 5 when moist, and chroma of 2 or 3 when dry and moist. The fine-earth texture is loam, clay loam, or silty clay loam. The content of rock fragments is 15 to 35 percent. Reaction is mildly alkaline or moderately alkaline.

The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 when dry and 3 to 5 when moist, and chroma of 2 or 3 when dry and moist. The fine-earth texture is clay loam or silty clay loam. The content of rock fragments is 15 to 50 percent. Reaction is moderately alkaline or strongly alkaline.

Aits Series

The Aits series consists of very deep, well drained soils on foothills and mountains. These soils formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slope is 0 to 65 percent. Elevation is 2,000 to 5,000 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are coarse-loamy, mixed, frigid Andic Xerochrepts.

Typical pedon of Aits loam, high precipitation, 40 to 65 percent slopes, about 0.5 mile north and 5.5 miles west of lone, 2,600 feet north and 2,600 feet east of the southwest corner of sec. 31, T. 38 N., R. 42 E.

Oe-1/2 inch to 0; partially decomposed organic litter of needles, twigs, leaves, bark, and cones; abrupt smooth boundary.

E-0 to 1/2 inch; light gray (10YR 7/1) very fine sandy loam (volcanic ash), gray (10YR 5/1) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; slightly acid; abrupt broken boundary.

Bw1-1/2 inch to 6 inches; brown (7.5YR 5/4) loam, dark brown (7.5YR 3/4) moist; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; weakly smeary; many fine and medium and few coarse roots; many fine and medium pores; about 5 percent pebbles; slightly acid; clear wavy boundary.

Bw2-6 to 12 inches; light brown (7.5YR 6/4) loam, dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure: soft, very friable, nonsticky and slightly plastic; weakly smeary; many fine and medium and few coarse roots; many fine and medium pores; about 10 percent pebbles; neutral; clear wavy boundary.

2BC-12 to 30 inches; very pale brown (10YR 7/4) gravelly loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine and medium pores; about 20 percent pebbles; neutral; clear wavy boundary.

2C-30 to 60 inches; light yellowish brown (2.5Y 6/4) gravelly loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; few fine and medium pores: about 30 percent pebbles; neutral.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. The mean annual soil temperature at a depth of about 20 inches ranges from 45 to 47 degrees F. The control section has 15 to 35 percent rock fragments. Some pedons have an A horizon. Some are stony to a depth of about 12 inches. Reaction is slightly acid or neutral throughout the profile.

The E horizon, if it occurs, has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 1 or 2 when dry and moist.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 to 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. The texture is silt loam or loam. The content of rock fragments is 5 to 15 percent.

The 2BC horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 when dry and 4 or 5 when moist, and chroma of 2 to 4 when dry and moist. The texture is gravelly silt loam, gravelly loam, or gravelly sandy loam.

The 2C horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 to 7 when dry and 4 or 5 when moist, and chroma of 2 to 4 when dry and moist. The texture is mainly gravelly silt loam, gravelly loam, or gravelly sandy loam, but the range includes clay loam and sandy clay loam and the content of pebbles is as much as 50 percent below a depth of 40 inches.

Anglen Series

The Anglen series consists of very deep, moderately well drained soils on terraces. These soils formed in a mantle of volcanic ash and loess over fine textured glacial lake sediments. Slope is 0 to 15 percent. Elevation is 2,100 to 3,000 feet. The average annual precipitation is 27 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are fine, mixed, frigid Andic Palexeralfs.

Typical pedon of Anglen silt loam, 0 to 7 percent slopes, about 1 mile east of lone, 1,000 feet south and 2,600 feet east of the northwest corner of sec. 5, T. 37 N., R. 43 E.

Oe-1 inch to 0; partially decomposed organic litter of needles, leaves, and twigs; abrupt smooth boundary.

Bw1-0 to 6 inches; pale brown (10YR 6/3) silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; common very fine and fine roots; common very fine and fine irregular pores; neutral; clear wavy boundary.

Bw2-6 to 11 inches; pale brown (10YR 6/3) silt loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; common very fine and fine and few coarse roots; common very fine and fine irregular pores; neutral; abrupt smooth boundary.

2E-11 to 21 inches; light gray (10YR 7/2) very fine sandy loam, light brownish gray (10YR 6/2) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine roots; common very fine and fine irregular pores; neutral; clear wavy boundary.

2B/E-21 to 30 inches; about 60 percent brown (10YR 5/3) silty clay loam (B part), dark brown (10YR 4/3) moist; moderate medium and coarse subangular blocky structure; hard, friable, sticky and plastic; few very fine and fine roots; common very fine and fine tubular pores; about 40 percent lamellae of light gray (10YR 7/2) silt loam (E part), brown (10YR 5/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few very fine, fine, and medium roots; common very fine and fine irregular pores; clay films in pores in the B part; slightly acid; clear wavy boundary.

2Bt-30 to 47 inches; light yellowish brown (2.5Y 6/4) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; very

hard, firm, very sticky and plastic; few very fine and fine roots; common very fine irregular pores; common moderately thick clay films on faces of peds and lining pores; dark brown (10YR 3/3 moist) organic stains between peds; neutral; gradual wavy boundary.

2BCt-47 to 60 inches; light olive gray (5Y 6/2) silty clay loam, olive gray (5Y 5/2) moist; moderate medium and thick platy and moderate medium and coarse subangular blocky structure; very hard, very firm, very sticky and plastic; few very fine and fine roots; few very fine irregular pores; common moderately thick clay films on faces of peds and lining pores; very dark brown (10YR 2/2 moist) organic stains between peds; neutral.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. The upper 20 inches of the argillic horizon ranges from 35 to 50 percent clay. The control section has as much as 5 percent rock fragments. Some pedons have an A horizon, which is as much as 4 inches thick. Some have a thin layer of light colored volcanic ash at the surface. Some have a C horizon.

The Bw horizon has hue of 10YR or 7.5YR, value of 5 to 7 when dry and 2 to 5 when moist, and chroma of 2 to 5 when dry and moist. Reaction is slightly acid or neutral.

The 2E horizon has hue of 2.5Y or 10YR, value of 6 to 8 when dry and 5 or 6 when moist, and chroma of 1 or 2 when dry and moist. The texture is silt loam, loam, or very fine sandy loam. Reaction is slightly acid or neutral.

The E part of the 2B/E horizon has hue of 2.5Y or 10YR, value of 6 to 8 when dry and 5 or 6 when moist, and chroma of 1 to 3 when dry and moist. Individual lamellae are 1/2 inch to 2 inches thick. The total thickness ranges from 3 to 8 inches. The E part is silt loam or very fine sandy loam. The B part has hue of 10YR or 2.5Y, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 2 to 4 when dry and moist. It is clay loam, silty clay loam, silty clay, or clay. Reaction is moderately acid to neutral.

The 2Bt horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 8 when dry and 4 or 5 when moist, and chroma of 2 to 4 when dry and moist. The texture is clay loam, silty clay loam, silty clay, or clay. Reaction is slightly acid or neutral.

The 2BCt horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 8 when dry and 4 to 6 when moist, and chroma of 1 to 3 when dry and moist. The texture is silt loam, silty clay loam, silty clay, or clay. Reaction is slightly acid or neutral.

Belzar Series

The Belzar series consists of moderately deep, well drained soils on foothills and mountains. These soils formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from calcareous rock and limestone. Slope is 20 to 65 percent. Elevation is 3,000 to 5,500 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 80 to 100 days.

These soils are loamy-skeletal, mixed, frigid Andic Xerochrepts.

Typical pedon of Belzar silt loam, high precipitation, 20 to 40 percent slopes, about 2 miles north and 5.75 miles west of Metaline Falls, 2,200 feet south and 1,400 feet east of the northwest corner of sec. 15, T. 39 N., R. 42 E.

Oe-1 inch to 0; partially decomposed organic litter of bark, needles, twigs, and leaves; abrupt smooth boundary.

Bw1-0 to 7 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; weak medium and coarse subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; common fine and medium and few coarse roots; many very fine and fine pores; about 5 percent hard shale fragments; neutral; clear wavy boundary.

Bw2-7 to 13 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; common fine and medium roots; common fine pores; about 10 percent hard shale fragments; neutral; clear wavy boundary.

2BC-13 to 20 inches; brown (10YR 5/3) channery loam, dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common fine and medium roots; common fine pores; about 30 percent hard shale fragments; slightly effervescent; mildly alkaline; clear wavy boundary.

2C1-20 to 30 inches; pale brown (10YR 6/3) very channery loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; few fine and medium pores; about 50 percent hard shale fragments; strongly effervescent; moderately alkaline; clear irregular boundary.

2C2-30 to 35 inches; pale brown (10YR 6/3) very channery loam, brown (10YR 5/3) moist; massive;

soft, very friable, slightly sticky and slightly plastic; few coarse roots; about 60 percent hard shale fragments; strongly effervescent; moderately alkaline; clear wavy boundary.

2R-35 inches; fractured limestone.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. The depth to bedrock ranges from 20 to 40 inches. The control section has 35 to 80 percent hard shale fragments or shaly channery fragments. A thin layer of light colored volcanic ash is at the surface in some pedons.

The Bw horizon has hue of 10YR, 7.5YR, or 5YR, value of 5 to 7 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. Reaction is slightly acid or neutral.

The 2BC horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. The texture is channery loam or channery silt loam. Reaction is neutral or mildly alkaline.

The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 when dry and 3 to 5 when moist, and chroma of 3 or 4 when dry and moist. The texture is very channery silt loam, very channery loam, or very channery silty clay loam. Reaction is mildly alkaline or moderately alkaline.

Blueslide Series

The Blueslide series consists of very deep, somewhat poorly drained soils on flood plains. These soils formed in alluvium derived dominantly from granitic rock, lacustrine sediments, volcanic ash, and loess. Slope is 0 to 3 percent. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 80 to 100 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are fine-loamy, mixed, frigid Fluvaquentic Haploxerolls.

Typical pedon of Blueslide silt loam, about 2.5 miles south and 2.75 miles east of Scotia, 1,500 feet south and 1,000 feet west of the northeast corner of sec. 27, T. 30 N., R. 45 E.

Ap-0 to 10 inches; grayish brown (10YR 5/2) silt loam, very dark gray (10YR 3/1) moist; moderate fine and medium granular structure; hard, firm, slightly sticky and plastic; many very fine and fine and few medium roots; few very fine and common fine discontinuous irregular pores; moderately acid; clear wavy boundary.

ACg-10 to 14 inches; gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) moist; moderate fine and medium subangular blocky structure; hard, firm, slightly sticky and plastic; common very fine and fine roots; few very fine and common fine discontinuous irregular pores; moderately acid; abrupt wavy boundary.

Cg1-14 to 30 inches; light gray (10YR 7/1) silt loam, dark gray (10YR 4/1) moist; few fine distinct mottles, strong brown (7.5YR 5/6) moist; massive; hard, firm, slightly sticky and plastic; few fine roots; few fine discontinuous irregular pores; slightly acid; clear wavy boundary.

Cg2-30 to 36 inches; light brownish gray (10YR 6/2) silt loam, dark gray (10YR 4/1) moist; many fine distinct mottles, strong brown (7.5YR 5/6) moist; massive; hard, firm, slightly sticky and plastic; few fine roots; few fine discontinuous irregular pores; neutral; abrupt wavy boundary.

Cg3-36 to 46 inches; light brownish gray (10YR 6/2) fine sandy loam, dark brown (10YR 3/3) moist; few fine faint mottles, dark yellowish brown (10YR 3/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; neutral; clear wavy boundary.

Cg4-46 to 60 inches; light brownish gray (10YR 6/2) silt loam, very dark gray (10YR 3/1) moist; few fine faint mottles, dark yellowish brown (10YR 3/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; slightly acid.

These soils are saturated during winter and spring. The mean annual soil temperature at a depth of about 20 inches ranges from 45 to 47 degrees F. The control section has 25 to 35 percent clay and less than 5 percent rock fragments.

The A horizon has value of 4 or 5 when dry and 2 or 3 when moist and chroma of 1 or 2 when dry and moist.

The ACg horizon has value of 5 or 6 when dry and 3 or 4 when moist and chroma of 1 or 2 when dry and moist.

The Cg horizon has value of 4 to 6 when dry and 3 to 5 when moist and chroma of 1 to 3 when dry and moist. It is dominantly silt loam, silty clay loam, loam, or fine sandy loam but has lenses of clay loam, sandy clay loam, or volcanic ash in some pedons. Reaction is slightly acid or neutral.

Bonner Series

The Bonner series consists of very deep, well drained soils on terraces. These soils formed in a mantle of volcanic ash and loess over glacial outwash of mixed mineralogy. Slope is 0 to 15 percent. Elevation

is 2,000 to 3,200 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 120 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are ashy over sandy or sandy-skeletal, mixed, frigid Typic Vitrixerands.

Typical pedon of Bonner silt loam, 0 to 10 percent slopes, about 0.25 mile west of Nile Lake, 200 feet south and 200 feet east of the northwest corner of sec. 2, T. 36 N., R. 42 E.

Oe-1 inch to 0; decomposed organic litter of needles, leaves, twigs, moss, and strobile; abrupt smooth boundary.

E-0 to 1/4 inch; light gray (10YR 7/2) very fine sandy loam (volcanic ash), grayish brown (10YR 5/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; slightly acid; abrupt broken boundary.

Bw1-1/4 inch to 6 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine and few coarse roots; many fine and very fine pores; about 5 percent pebbles; slightly acid; clear wavy boundary.

Bw2-6 to 12 inches; light brown (7.5YR 6/4) silt loam, dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many fine and medium and few coarse roots; many very fine and fine pores; about 10 percent pebbles; slightly acid; clear wavy boundary.

2BC-12 to 24 inches; very pale brown (10YR 7/4) gravelly loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; many fine and medium and few coarse roots; many very fine and fine pores; about 25 percent pebbles; neutral; clear wavy boundary.

3C1-24 to 36 inches; very pale brown (10YR 7/3) very cobbly loamy sand, brown (10YR 5/3) moist; few distinct dark brown (10YR 3/3) stains on some sand grains; single grain; loose; few very fine and fine roots; about 35 percent pebbles and 20 percent cobbles; neutral; clear wavy boundary.

3C2-36 to 60 inches; very pale brown (10YR 7/3) very cobbly loamy sand, brown (10YR 5/3) moist; single grain; loose; few very fine and fine roots; about 35 percent pebbles and 20 percent cobbles; neutral.

Reaction is neutral to moderately acid throughout the profile.

The E horizon, if it occurs, has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 1 or 2 when dry and moist.

The Bw horizon has hue of 10YR or 7.5YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. The texture is silt loam, loam, gravelly loam, or gravelly silt loam.

The 2BC horizon has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 3 or 4 when dry and moist. The texture is gravelly loam or gravelly sandy loam.

The 3C horizon has hue of 10YR or 2.5Y, value of 6 or 7 when dry and 4 or 5 when moist, and chroma of 2 to 4 when dry and moist. The fine-earth texture is loamy coarse sand, loamy sand, or sand. The content of pebbles and cobbles is 35 to 70 percent.

Boundary Series

The Boundary series consists of very deep, well drained soils on foothills and mountains. These soils formed in a mantle of volcanic ash and loess over calcareous, fine textured glacial till. Slope is 0 to 65 percent. Elevation is 3,000 to 4,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are loamy-skeletal, mixed, frigid Andic Haploxeralfs.

Typical pedon of Boundary silt loam, 0 to 30 percent slopes, about 1.75 miles south and 3.75 miles east of Boundary Dam, 660 feet north and 660 feet east of the southwest corner of sec. 17, T. 40 N., R. 44 E.

Oe-1 inch to 0; decomposed needles, leaves, twigs, bark, cones, and seeds; abrupt smooth boundary.

E-0 to 1/2 inch; gray (10YR 6/1) very fine sandy loam (volcanic ash), dark gray (10YR 4/1) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and medium roots; about 5 percent pebbles; moderately acid; abrupt broken boundary.

Bw-1/2 inch to 10 inches; yellowish brown (10YR 5/4) silt loam, dark brown (7.5YR 3/4) moist; weak very fine subangular blocky structure; soft, very friable, nonsticky and slightly plastic; moderately smeary; common very fine and fine and few medium and coarse roots; about 10 percent pebbles; moderately acid:, clear wavy boundary.

2Bt1-10 to 15 inches; light yellowish brown (2.5Y 6/4) very gravelly silt loam, olive brown (2.5Y 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few very fine, fine, and coarse roots; few moderately thick clay films on faces of peds and lining pores; about 30 percent pebbles and 5 percent cobbles; moderately acid; clear wavy boundary.

2Bt2-15 to 21 inches; pale olive (5Y 6/4) very gravelly silty clay loam, olive (5Y 4/3) moist; moderate medium angular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; many thick clay films on faces of peds and lining pores; about 30 percent pebbles and 10 percent cobbles; neutral; clear wavy boundary.

2Bt3-21 to 25 inches; olive (5Y 5/3) very gravelly silt loam, olive (5Y 4/3) moist; moderate fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; common moderately thick clay films on faces of peds and common thick clay films lining pores; about 30 percent pebbles and 10 percent cobbles; mildly alkaline; clear wavy boundary.

2Bk-25 to 40 inches; pale olive (5Y 6/3) very gravelly silt loam, olive (5Y 4/3) moist; moderate medium and thick platy structure; hard, firm, slightly sticky and plastic; about 30 percent pebbles and 15 percent cobbles; lime segregated in common small rounded soft masses and as pendants below pebbles and cobbles; strongly effervescent; mildly alkaline; clear wavy boundary.

2C-40 to 60 inches; light olive gray (5Y 6/2) very gravelly silty clay loam, olive gray (5Y 5/2) moist; moderate medium and thick platy structure; hard, firm, very sticky and plastic; about 35 percent pebbles and 10 percent cobbles; strongly effervescent; moderately alkaline.

The mantle of volcanic ash ranges from 7 to 14 inches in thickness. The argillic horizon ranges from 20 to 35 percent clay. The thickness of the solum and the depth to free carbonates typically are 23 to 30 inches but range to 35 inches. The control section has 35 to 50 percent rock fragments.

The E horizon, if it occurs, has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 1 or 2 when dry and moist.

The Bw horizon has hue of 10YR or 7.5YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. It has 0 to 10 percent rock fragments.

The 2Bt horizon has hue of 2.5Y or 5Y, value of 5 to 7 when dry, and chroma of 3 or 4 when moist and 2 to 4 when dry. The texture is very gravelly silt loam, very gravelly clay loam, or very gravelly silty clay loam. Reaction is moderately acid to mildly alkaline.

The 2Bk horizon is very gravelly silt loam, very gravelly clay loam, or very gravelly silty clay loam. It is mildly alkaline or moderately alkaline. It is strongly effervescent or violently effervescent when treated with dilute hydrochloric acid.

The 2C horizon has value of 4 or 5 when moist and chroma of 2 or 3 when dry and moist. It is very gravelly clay loam or very gravelly silty clay loam. It is slightly effervescent to strongly effervescent when treated with dilute hydrochloric acid.

Brickel Series

The Brickel series consists of moderately deep, well drained soils on mountains. These soils formed in residuum and colluvium derived dominantly from granitic rock. The residuum and colluvium have an admixture of volcanic ash and loess. Slope is 20 to 60 percent. Elevation is 5,000 to 7,000 feet. The average annual precipitation is 35 to 45 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 60 to 80 days.

These soils are loamy-skeletal, mixed Vitrandic Cryoborolls.

Typical pedon of Brickel stony loam, 20 to 60 percent slopes, about 0.25 mile west of Timber Mountain Lookout, 500 feet east of the northwest corner of sec. 24, T. 35 N., R. 42 E.

A-0 to 13 inches; grayish brown (10YR 5/2) stony loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine and many fine roots; many very fine and fine pores; about 10 percent stones and 15 percent pebbles; moderately acid; clear wavy boundary.

Bw-13 to 23 inches; brown (10YR 5/3) very stony loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; common fine and very fine pores; about 20 percent stones, 10 percent cobbles, and 15 percent pebbles; moderately acid; clear wavy boundary.

C-23 to 36 inches; pale brown (10YR 6/3) very stony sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; common very fine and fine

pores; about 25 percent stones, 15 percent cobbles, and 15 percent pebbles; moderately acid; abrupt irregular boundary.

R-36 inches; fractured granite with some fines in the fracture planes.

The depth to bedrock ranges from 24 to 40 inches. The mean annual soil temperature at a depth of about 20 inches ranges from 40 to 42 degrees F. The control section has 40 to 70 percent rock fragments. Reaction is slightly acid or moderately acid throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 3 to 5 when dry and 2 or 3 when moist, and chroma of 1 or 2 when dry and moist.

The Bw horizon has hue of 7.5YR or 10YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. It is the very stony or extremely stony analogs of fine sandy loam, loam, or silt loam.

The C horizon has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 3 or 4 when dry and moist. It is the very cobbly, very stony, extremely cobbly, or extremely stony analogs of sandy loam or loam.

Buhrig Series

The Buhrig series consists of moderately deep, well drained soils on mountains. These soils formed in a mantle of volcanic ash and loess and in residuum and colluvium derived from metasedimentary and igneous rocks. Slope is 25 to 65 percent. Elevation is 3,000 to 6,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 80 to 100 days.

These soils are loamy-skeletal, mixed Andic Cryochrepts.

Typical pedon of Buhrig very stony loam, 40 to 65 percent slopes, about 0.25 mile west of Salmo Mountain Lookout, 2,500 feet south and 2,400 feet west of the northeast corner of sec. 16, T. 40 N., R. 45 E.

Oe-1/2 inch to 0; partially decomposed needles, leaves, twigs, and cones; abrupt smooth boundary.

A-0 to 3 inches; grayish brown (10YR 5/2) very stony loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; many very fine and fine roots; many fine pores; about 10 percent pebbles, 20 percent cobbles, and 25 percent stones; slightly acid; clear wavy boundary.

Bw1-3 to 7 inches; light yellowish brown (10YR 6/4) extremely stony loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine pores; about 10 percent pebbles, 25 percent cobbles, and 35 percent stones; slightly acid; abrupt smooth boundary.

Bw2-7 to 11 inches; light yellowish brown (10YR 6/4) extremely stony sandy loam, dark yellowish brown (1 OYR 4/4) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many very fine and fine roots; many fine pores; about 10 percent pebbles, 25 percent cobbles, and 40 percent stones; slightly acid; clear wavy boundary.

2C-11 to 30 inches; light yellowish brown (2.5Y 6/4) extremely stony sandy loam, olive brown (2.5Y 4/4) moist; massive; soft, very friable, slightly sticky and nonplastic; common very fine and fine roots; common fine pores; about 20 percent pebbles; about 60 percent fractured rock with fines in the fractures; slightly acid; clear wavy boundary.

2R-30 inches; fractured quartzite.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. The depth to bedrock ranges from 20 to 40 inches. The control section has 50 to 90 percent rock fragments. Reaction is neutral or slightly acid throughout the profile. A thin layer of light colored volcanic ash is at the surface in some pedons.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 2 or 3 when dry and moist.

The Bw horizon has hue of 7.5YR or 10YR, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. The texture is extremely stony loam or extremely stony sandy loam.

The 2C horizon has hue of 10YR or 2.5Y, value of 5 or 6 when dry and 3 to 5 when moist, and chroma of 3 or 4 when dry and moist.

Clayton Series

The Clayton series consists of *very* deep, well drained soils on terraces. These soils formed in glaciofluvial material of mixed mineralogy. This material has an admixture of volcanic ash and loess in the upper part. Slope is 0 to 15 percent. Elevation is 1,800 to 2,200 feet. The average annual precipitation is 22 to 27 inches, the average annual air temperature is about 46 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are coarse-loamy, mixed, mesic Vitrandic Xerochrepts.

Typical pedon of Clayton fine sandy loam, 0 to 5

percent slopes, about 0.5 mile north and 1.75 miles west of Camden, 2,400 feet north and 500 feet east of the southwest corner of sec. 32, T. 30 N., R. 44 E.

Oe-1/2 inch to 0; partially decomposed organic litter of needles, leaves, and twigs; abrupt smooth boundary.
Bw1-0 to 7 inches; brown (10YR 5/3) fine sandy loam, dark brown (7.5YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; few very fine and fine discontinuous pores; slightly acid; diffuse broken boundary.
Bw2-7 to 17 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; few very fine and fine discontinuous pores; slightly acid; clear wavy boundary.
E-17 to 28 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; few very fine and fine discontinuous pores; slightly acid; abrupt wavy boundary.
E/B-28 to 47 inches; very pale brown (10YR 7/4) loamy fine sand, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few medium roots; few very fine and fine discontinuous pores; common prominent loamy bands that are 1/6 to 1/4 inch thick, dark brown (7.5YR 4/4) moist; slightly acid; clear wavy boundary.
C-47 to 60 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few medium roots; few very fine and fine discontinuous pores; slightly acid.

The control section has as much as 10 percent rock fragments and has less than 18 percent clay and more than 15 percent particles coarser than very fine sand. A thin layer of light colored volcanic ash is at the surface in some pedons. Reaction is neutral or slightly acid throughout the profile.

The A or Ap horizon, if it occurs, has hue of 10YR, value of 4 to 6 when dry and 3 or 4 when moist, and chroma of 2 or 3 when dry and moist.

The Bw horizon has hue of 10YR or 7.5YR, value of 4 to 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. The texture is fine sandy loam or loam.

The E horizon has hue of 2.5Y or 10YR, value of 4 to 6 when dry and 3 to 5 when moist, and chroma of 3 or 4 when dry and moist.

The E part of the E/B horizon has hue of 2.5Y or 10YR, value of 4 to 7 when dry and 3 to 5 when moist, and chroma of 3 or 4 when dry and moist. The texture is fine sandy loam or loamy fine sand. The B part occurs as bands of loam or sandy loam 1/16 to 1 inch thick. The total thickness of the bands is less than 6 inches.

The C horizon, if it occurs, has hue of 2.5Y or 10YR, value of 5 to 7 when dry and 3 to 5 when moist, and chroma of 3 or 4 when dry and moist. The texture is fine sandy loam or loamy fine sand.

Conto Series

The Conto series consists of very deep, well drained soils on mountains. These soils formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slope is 0 to 65 percent. Elevation is 4,000 to 5,800 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is about 38 degrees F, and the average growing season (at 28 degrees) is 60 to 90 days.

These soils are loamy-skeletal, mixed Andic Haplocryods.

Typical pedon of Conto silt loam, 0 to 30 percent slopes, about 1.3 miles south and 7.25 miles west of Boundary Dam, 1,600 feet north and 1,850 feet east of the southwest corner of sec. 13, T. 40 N., R. 44 E.

Oe-1 inch to 0; partially decomposed needles, leaves, twigs, barks, cones, and moss; abrupt smooth boundary.
E-0 to 3 inches; gray (10YR 6/1) very fine sandy loam (volcanic ash), dark gray (10YR 4/1) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine and fine and common medium and coarse roots; about 10 percent pebbles; very strongly acid; abrupt wavy boundary.
Bs1-3 to 7 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; weak very fine and fine subangular blocky structure; soft, very friable, nonsticky and slightly plastic; moderately smeary; common very fine, fine, medium, and coarse roots; about 10 percent pebbles; moderately acid; clear *wavy* boundary.
Bs2-7 to 12 inches; brownish yellow (10YR 6/6) silt loam, dark yellowish brown (10YR 4/6) moist; weak very fine and fine subangular blocky structure; soft, very friable, nonsticky and slightly plastic; weakly smeary; common very fine, fine, medium, and

coarse roots; about 10 percent pebbles; moderately acid; clear wavy boundary.

2C1-12 to 17 inches; light yellowish brown (2.5Y 6/4) very gravelly sandy loam, olive brown (2.5Y 4/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; about 35 percent pebbles and 5 percent cobbles; very strongly acid; clear wavy boundary.

2C2-17 to 34 inches; olive (5Y 5/3) very gravelly sandy loam, olive (5Y 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; about 40 percent pebbles and 5 percent cobbles; very strongly acid; clear wavy boundary.

2C3-34 to 60 inches; pale olive (SY 6/3) very gravelly sandy loam, olive (5Y 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; about 45 percent pebbles and 10 percent cobbles; very strongly acid.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. The control section has 35 to 60 percent rock fragments. Reaction ranges from very strongly acid to moderately acid throughout the profile.

The E horizon, if it occurs, has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 1 or 2 when dry and moist.

The Bs horizon generally has hue of 5YR, 7.5YR, or 10YR, value of 5 to 7 when dry and 3 or 4 when moist, and chroma of 4 to 6 when dry and 3 to 6 when moist. The texture is sandy loam or silt loam. At the higher elevations, the upper part of the horizon is brittle and slightly hard or hard and has hue of 2.5YR when moist.

The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6 when dry, and chroma of 3 or 4 when dry and moist.

Conto Variant

The Conto Variant consists of very deep, well drained soils on mountains. These soils formed in a mantle of volcanic ash and loess over calcareous glacial till. Slope is 0 to 65 percent. Elevation is 3,900 to 5,200 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is about 38 degrees F, and the average growing season (at 28 degrees) is 60 to 90 days.

These soils are loamy-skeletal, mixed Andic Haplocryods.

Typical pedon of Conto Variant sandy loam, 0 to 30 percent slopes, about 0.25 mile south and 6.75 miles east of Boundary Dam, 1,320 feet south and 1,200 feet west of the northeast corner of sec. 11, T. 40 N., R. 44 E.

Oe-1 inch to 0; partially decomposed needles, leaves, twigs, bark, and cones; abrupt smooth boundary.

E-0 to 1/2 inch; gray (10YR 6/1) very fine sandy loam (volcanic ash), dark gray (10YR 4/1) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and medium roots; about 5 percent pebbles; moderately acid; abrupt broken boundary.

Bs1-1/2 inch to 6 inches; yellowish red (5YR 5/6) sandy loam, dark reddish brown (5YR 3/4) moist; weak very fine and fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; moderately smeary; common very fine and fine and many medium and coarse roots; about 10 percent pebbles; moderately acid; abrupt wavy boundary.

Bs2-6 to 9 inches; strong brown (7.5YR 5/6) sandy loam, dark brown (7.5YR 3/4) moist; weak very fine and fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; moderately smeary; common very fine, fine, medium, and coarse roots; about 10 percent pebbles; moderately acid; clear wavy boundary.

2BC1-9 to 15 inches; dark yellowish brown (10YR 4/6) gravelly loam, strong brown (7.5YR 3/6) moist; weak very fine and fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; moderately smeary; common very fine, fine, medium, and coarse roots; about 30 percent. pebbles; slightly acid; clear wavy boundary.

2BC2-15 to 35 inches; light olive brown (2.5Y 5/4) very gravelly very fine sandy loam, olive brown (2.5Y 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; moderately smeary; few very fine and fine and common medium and coarse roots; about 35 percent pebbles and 10 percent cobbles; neutral; clear wavy boundary.

2BC3-35 to 40 inches; pale yellow (2.5Y 7/4) very gravelly silt loam, light olive brown (2.5Y 5/4) moist; moderate very fine, fine, and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; about 30 percent pebbles and 5 percent cobbles; strongly effervescent; moderately alkaline; abrupt wavy boundary.

3C-40 to 60 inches; pale yellow (2.5Y 7/4) very gravelly loamy sand, light olive brown (2.5Y 5/4) moist; single grain; loose; few very fine and fine roots; about 40 percent pebbles and 10 percent cobbles; strongly effervescent; moderately alkaline.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. The depth to free carbonates

is typically about 25 inches, but it ranges from 15 to 35 inches. The content of rock fragments in the control section is 35 to 60 percent.

The E horizon has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 1 or 2 when dry and moist. Reaction is slightly acid or moderately acid.

The Bs horizon has hue of 5YR or 7.5YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 to 6 when dry and moist. The texture is sandy loam, gravelly loam, or silt loam. Reaction is slightly acid or moderately acid.

The 2BC1 horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 or 5 when dry and 3 or 4 when moist, and chroma of 4 to 6 when dry and moist. The texture is sandy loam, gravelly loam, or silt loam. Reaction is slightly acid or moderately acid.

The 2BC2 and 2BC3 horizons have hue of 2.5Y or 5Y, value of 5 to 7 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. The texture is very gravelly very fine sandy loam, very gravelly sandy loam, or very gravelly silt loam. Reaction is slightly acid to moderately alkaline.

The 3C horizon has hue of 2.5Y or 5Y, value of 5 to 7 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. It is mildly alkaline or moderately alkaline and is slightly effervescent to strongly effervescent.

Cusick Series

The Cusick series consists of very deep, somewhat poorly drained soils in basins. These soils formed in fine textured glacial lake sediments. Slope is 0 to 3 percent. Elevation is 2,000 to 2,200 feet. The average annual precipitation is 25 to 27 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 100 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are fine, mixed, frigid Aquic Haploxeralfs.

Typical pedon of Cusick silty clay loam, about 3 miles north and 1.5 miles east of Cusick, 200 feet north and 200 feet west of the southeast corner of sec. 2, T. 33 N., R. 43 E.

Ap-0 to 7 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; weak fine granular structure; hard, firm, sticky and plastic; many fine roots; many fine irregular pores; slightly acid; abrupt smooth boundary.

Bt1-7 to 17 inches; light gray (5Y 7/1) silty clay, fight brownish gray (10YR 6/2) moist; few very fine faint brownish yellow (10YR 6/6) mottles near root channels, yellowish brown (10YR 5/4) moist; moderate medium prismatic structure parting to moderate medium angular blocky; hard, very firm, sticky and very plastic; common fine roots within prisms and many fine roots on prism faces; common very fine and fine tubular pores; gray (10YR 5/1) continuous moderately thick clay films on faces of peds and in root channels and pores, dark gray (10YR 4/1) moist; neutral; clear wavy boundary.

Bt2-17 to 37 inches; light gray (5Y 7/1) silty clay, light brownish gray (10YR 6/2) moist; common fine distinct brownish yellow (10YR 6/6) mottles, dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) moist; moderate coarse prismatic structure; hard, firm, sticky and plastic; few fine roots within prisms and many fine roots on prism faces; common very fine and few fine tubular pores; gray (10YR 5/1) continuous moderately thick clay films on prism faces and in pores, dark gray (10YR 4/1) moist; neutral; gradual wavy boundary.

C1-37 to 58 inches; white (2.5Y 8/1) silty clay, light brownish gray (10YR 6/2) moist; common fine faint and distinct brownish yellow (10YR 6/6) mottles, yellowish brown (10YR 5/6) moist; massive; hard, firm, sticky and plastic; few fine roots; common very fine tubular and few fine vertical tubular pores; neutral; clear smooth boundary.

2C2-58 to 60 inches; white (2.5Y 8/1) very fine sandy loam, light gray (10YR 7/2) moist; common fine faint and distinct brownish yellow (10YR 6/6) mottles, yellowish brown (10YR 5/6) moist; massive; hard, firm, sticky and plastic; few fine roots; common very fine tubular and few fine vertical tubular pores; neutral.

The control section has 39 to 49 percent clay. The soils are usually saturated from November through April. A water table is within a depth of 2 feet in winter and early spring.

The A horizon has value of 5 or 6 when dry and 3 or 4 when moist and chroma of 1 or 2 when dry and moist. Reaction is moderately acid or slightly acid.

The Bt horizon has value of 7 or 8 when dry and 5 or 6 when moist and chroma of 1 or 2 when dry and 2 or 3 when moist. Reaction is slightly acid or neutral.

The C horizon has hue of 2.5Y or 10YR, value of 7 or 8 when dry and 5 to 7 when moist, and chroma of 1 or 2 when dry and moist. The texture is silty clay or silty clay loam to a depth of 50 inches but ranges to very fine sandy loam below that depth.

Dalkena Series

The Dalkena series consists of very deep, moderately well drained soils on terraces. These soils

formed in glaciofluvial deposits over clayey glacial lake sediments. Slope is 0 to 40 percent. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are coarse-loamy over clayey, mixed, frigid Vitrandic Xerochrepts.

Typical pedon of Dalkena fine sandy loam, 7 to 15 percent slopes, about 2.75 miles east of Sacheen Lake, 1,500 feet south and 4,000 feet east of the northwest corner of sec. 27, T. 32 N., R. 44 E.

A-0 to 8 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and nonplastic; many very fine and fine and few medium and coarse roots; neutral; clear wavy boundary.

Bw1-8 to 14 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common *very* fine and fine and few medium and coarse roots; neutral; clear wavy boundary.

Bw2-14 to 24 inches; light gray (10YR 7/2) fine sandy loam, brown (10YR 5/3) moist; common fine distinct mottles, light yellowish brown (10YR 6/4) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few very fine, fine, medium, and coarse roots; neutral; clear wavy boundary.

C1-24 to 30 inches; light gray (10YR 7/2) sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky and nonplastic; few very fine, fine, medium, and coarse roots; slightly acid; clear wavy boundary.

2C2-30 to 42 inches; light gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) moist; common fine distinct mottles, light yellowish brown (10YR 6/4) moist; moderate thin and medium platy structure; hard, firm, sticky and plastic; few very fine, fine, medium, and coarse roots; slightly acid; clear wavy boundary.

2C3-42 to 60 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; common fine distinct mottles, light yellowish brown (10YR 6/4) moist; moderate thin and medium platy structure; hard, firm, sticky and plastic; few very fine, fine, medium, and coarse roots; slightly acid.

The depth to clayey lake sediments ranges from 20 to 36 inches.

The A horizon has value of 5 or 6 when dry and 3 or 4 when moist and chroma of 2 or 3 when dry and moist.

The Bw horizon is fine sandy loam or sandy loam. Reaction is slightly acid or neutral.

The C horizon has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 2 or 3 when dry and moist. The texture is fine sandy loam or sandy loam. Reaction is slightly acid or neutral.

The 2C horizon has hue of 10YR or 2.5Y, value of 6 or 7 when dry and 5 or 6 when moist, and chroma of 1 to 3 when dry and moist. The texture is silty clay loam or silty clay.

Dufort Series

The Dufort series consists of very deep, well drained soils on foothills. These soils formed in a thick mantle of volcanic ash and loess over glacial drift of mixed mineralogy. Slope is 0 to 40 percent. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are ashy over loamy-skeletal, mixed, frigid Typic Vitrixerands.

Typical pedon of Dufort silt loam, 0 to 15 percent slopes, about 0.6 mile north and 3 miles west of Newport, 2,200 feet south and 700 feet west of the northeast corner of sec. 16, T. 31 N., R. 45 E.

Oe-1 inch to 0; partially decomposed organic litter of needles, leaves, and twigs; abrupt smooth boundary.

E-0 to 1/4 inch; light gray (10YR 7/1) very fine sandy loam (volcanic ash), gray (10YR 5/1) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; slightly acid; abrupt smooth boundary.

Bw1-1/4 inch to 5 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 3/4) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine roots; many very fine pores; about 3 percent pebbles; slightly acid; clear wavy boundary.

Bw2-5 to 18 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine roots; many very fine pores; about 5 percent pebbles; slightly acid; clear wavy boundary.

2BC-18 to 30 inches; pale brown (10YR 6/3) gravelly

loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; many very fine and fine roots; many very fine pores; about 20 percent pebbles; slightly acid; clear wavy boundary.

2C-30 to 60 inches; pale brown (10YR 6/3) very gravelly sandy loam, dark brown (10YR 4/3) moist; common medium distinct mottles, dark brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine roots; common very fine pores; about 30 percent pebbles and 10 percent cobbles; slightly acid.

The mantle of volcanic ash and loess ranges from 14 to 24 inches in thickness. The upper part of the control section has 35 to 60 percent pyroclastic material and less than 15 percent rock fragments. The lower part has more than 35 percent rock fragments. Some pedons have a very stony surface layer. Reaction is neutral to moderately acid throughout the profile.

The E horizon, if it occurs, has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 1 or 2 when dry and moist. The texture is very fine sandy loam or silt loam.

The Bw and 2BC horizons have hue of 7.5YR or 10YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. The texture is silt loam, loam, gravelly loam, or gravelly silt loam.

The 2C horizon has hue of 10YR or 2.5Y, value of 6 or 7 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. The texture is gravelly loam, very gravelly sandy loam, very cobbly sandy loam, or very gravelly fine sandy loam.

Eloika Series

The Eloika series consists of very deep, well drained soils on terraces. These soils formed in a thick mantle of volcanic ash and loess over glacial drift of mixed mineralogy. Slope is 0 to 15 percent. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 22 to 28 inches, the average annual air temperature is about 46 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are ashy over loamy, mixed, frigid Typic Vitrixerands.

Typical pedon of Eloika silt loam, 0 to 15 percent slopes, about 1.75 miles east and 0.20 mile south of Fan Lake, 650 feet north and 650 feet east of the southwest corner of sec. 34, T. 30 N.. R. 43 E.

Oe-1 inch to 0; partially decomposed organic litter of needles, leaves, and twigs; abrupt smooth boundary.

E-0 to 1/4 inch; light gray (10YR 7/1) very fine sandy loam (volcanic ash), gray (10YR 5/1) moist; weak fine granular structure; soft, very friable, nonsticky .and nonplastic; slightly acid; abrupt smooth boundary.

Bw1-1/4 inch to 5 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 3/4) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine and few medium and coarse roots; many very fine and fine pores; about 5 percent pebbles; slightly acid; clear wavy boundary.

Bw2-5 to 14 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine and few medium and coarse roots; many very fine pores; about 5 percent pebbles; slightly acid; clear wavy boundary.

2BC-14 to 20 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many very fine and fine and few medium and coarse roots; many very fine and fine pores; about 10 percent pebbles; slightly acid; clear wavy boundary.

2C1-20 to 40 inches; pale brown (10YR 6/3) gravelly loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine and few medium and coarse roots; many very fine and fine pores; about 20 percent pebbles and 10 percent cobbles; slightly acid; clear wavy boundary.

2C2-40 to 50 inches; pale brown (10YR 6/3) very gravelly sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and nonplastic; few very fine and fine roots; common very fine pores; about 35 percent pebbles and 10 percent cobbles; slightly acid; clear wavy boundary.

3C3-50 to 60 inches; multicolored extremely gravelly coarse sand; single grain; loose; few roots; about 50 percent pebbles and 15 percent cobbles; coatings of sandy loam on some pebbles; slightly acid.

The mantle of volcanic ash and loess ranges from 14 to 20 inches in thickness. The upper part of the control section has 35 to 60 percent amorphous pyroclastic material and less than 15 percent gravel. The entire

control section has less than 35 percent rock fragments. Reaction is neutral or slightly acid throughout the profile.

The E horizon, if it occurs, has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 1 or 2 when dry and moist.

The Bw horizon has hue of 7.5YR or 10YR, value of 5 to 7 when dry and 3 to 5 when moist, and chroma of 3 or 4 when dry and moist. The texture is silt loam or loam. The content of rock fragments is as much as 5 percent.

The 2BC horizon has hue of 7.5YR or 10YR, value of 6 or 7 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. The texture is silt loam or loam. The content of rock fragments is 5 to 15 percent.

The 2C horizon has value of 6 or 7 when dry and 4 or 5 when moist. The texture is gravelly loam or gravelly sandy loam to a depth of about 40 inches and is very gravelly sandy loam or very gravelly loam below that depth.

The 3C horizon is very gravelly loamy sand, extremely gravelly coarse sand, or very gravelly sand.

Hartill Series

The Hartill series consists of moderately deep, well drained soils on mountains. These soils formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from phyllite and quartzite. Slope is 0 to 65 percent. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 27 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are loamy-skeletal, mixed, frigid Andic Xerochrepts.

Typical pedon of Hartill silt loam, 25 to 40 percent slopes, about 2.6 miles south and 8.75 miles west of Cusick, 2,100 feet north and 200 feet east of the southwest corner of sec. 3, T. 32 N., R. 42 E.

Oe-1 1/2 inches to 0; partially decomposed organic litter of needles, leaves, bark, moss, and twigs; abrupt smooth boundary.

E-0 to 1/4 inch; light gray (10YR 7/1) very fine sandy loam (volcanic ash), dark gray (10YR 4/1) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine irregular pores; neutral; abrupt wavy boundary.

Bw1-1/4 inch to 8 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many fine and medium and few coarse roots; many fine and medium irregular and tubular pores; about 5 percent shale fragments; neutral; clear wavy boundary.

Bw2-8 to 12 inches; pale brown (10YR 6/3) silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary, many fine and medium roots; many fin and medium tubular and irregular pores; about 10 percent shale fragments; slightly acid; clear wavy boundary.

2BC-12 to 18 inches; light yellowish brown (10YR 6/4) channery loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and few medium and coarse roots; common fine and medium pores; about 25 percent channers and 5 percent flagstones; slightly acid; clear wavy boundary.

2C1-18 to 27 inches; light yellowish brown (10YR 6/4) very channery loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; few fine and medium pores; about 35 percent channers and 5 percent flagstones; slightly acid; clear wavy boundary.

2C2-27 to 36 inches; very pale brown (10YR 7/4) very channery loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine and common medium and coarse roots; many very fine and fine pores; about 40 percent channers and 10 percent flagstones; neutral; clear wavy boundary.

2R-36 inches; fractured phyllite that has fines in some voids.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. The depth to bedrock ranges from 20 to 40 inches. The control section has 35 to 50 percent rock fragments. Reaction is neutral or slightly acid throughout the profile.

The E horizon, if it occurs, has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 1 or 2 when dry and moist.

The Bw horizon has hue of 10YR or 7.5YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. The texture is silt loam or loam. The content of channers is 5 to 15 percent.

The 2BC horizon has hue of 10YR or 2.5Y, value of 5 to 7 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. The fine-earth texture is loam or sandy loam. The content of channers is 15 to 60 percent.

The 2C horizon has hue of 10YR or 2.5Y, value of 6 or 7 when dry and 4 to 6 when moist, and chroma of 3 or 4 when dry and moist. The fine-earth texture is loam or sandy loam. The content of channers is 35 to 70 percent.

Hoodoo Series

The Hoodoo series consists of very deep, poorly drained soils adjacent to drainageways and on flood plains. Drainage has been altered by tiles. These soils formed in alluvium derived dominantly from volcanic ash. Slope is 0 to 2 percent. Elevation is 2,000 to 2,800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are ashy, frigid Typic Vitraquands.

Typical pedon of Hoodoo silt loam, about 1.5 miles south and 2.2 miles west of Newport, on Deer Valley Road, 1,400 feet north and 800 feet west of the southeast corner of sec. 27, T. 31 N., R. 45 E.

Ap-0 to 6 inches; grayish brown (10YR 5/2) silt loam, black (10YR 2/1) moist; moderate fine granular structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine and common medium roots; many very fine and fine pores; slightly acid; abrupt smooth boundary.

A-6 to 12 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine and common medium roots; many very fine and fine pores; slightly acid; clear wavy boundary.

ACg-12 to 14 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; few fine and medium distinct mottles, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; weakly smeary; common very fine, fine, and medium roots; common very fine and fine pores; slightly acid; clear wavy boundary.

Cg1-14 to 18 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; few fine and medium distinct mottles, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and nonplastic; weakly smeary; common very fine, fine, and medium roots; common very fine and fine pores; slightly acid; clear wavy boundary.

Cg2-18 to 30 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; common fine and medium distinct mottles, yellowish brown (10YR 5/6) moist; massive; slightly hard, friable, slightly sticky and nonplastic; weakly smeary; common very fine and fine and few medium roots; common very fine and fine pores; slightly acid; clear wavy boundary.

Cg3-30 to 36 inches; light gray (10YR 7/2) silt loam, light brownish gray (10YR 6/2) moist; common fine and medium distinct mottles, reddish yellow (5YR 6/6) moist; massive; slightly hard, friable, slightly sticky and nonplastic; weakly smeary; few very fine and fine pores; slightly acid; clear wavy boundary.

Cg4-36 to 45 inches; light gray (2.5Y 7/2) silt loam, light brownish gray (2.5Y 6/2) moist; many fine and medium distinct mottles, yellowish brown (10YR 5/6) moist; massive; slightly hard, friable, slightly sticky and nonplastic; weakly smeary; few very fine and medium roots; few very fine and fine pores; slightly acid; clear wavy boundary.

Cg5-45 to 60 inches; light gray (2.5Y 7/2) very fine sandy loam, light brownish gray (2.5Y 6/2) moist; many fine and medium distinct mottles, yellowish brown (10YR 5/6) moist; massive; slightly hard, friable, slightly sticky and nonplastic; weakly smeary; few very fine and fine roots; few very fine and fine pores; slightly acid.

Reaction is moderately acid to neutral throughout the profile.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 1 or 2 when dry and moist.

The ACg horizon has hue of 10YR or 2.5Y, value of 4 to 6 when dry and 2 to 4 when moist, and chroma of 1 or 2 when dry and moist.

The Cg horizon has hue of 10YR, 2.5Y, or 5Y, value of 6 to 8 when dry and 5 to 7 when moist, and chroma of 1 or 2 when dry and moist. It has few to many distinct mottles. The texture is silt loam, loam, or very fine sandy loam.

Huckleberry Series

The Huckleberry series consists of moderately deep, well drained soils on mountains. These soils formed in a thick mantle of volcanic ash and loess over residuum and colluvium derived dominantly from phyllite and quartzite. Slope is 0 to 65 percent. Elevation is 3,000 to 6,000 feet. The average annual precipitation is 30 to 45 inches, the average annual air temperature is about 39 degrees F, and the average growing season (at 28 degrees) is 70 to 90 days.

These soils are ashy over loamy-skeletal, mixed Typic Vitricryands.

Typical pedon of Huckleberry silt loam, 40 to 65 percent slopes, about 4 miles north and 2 miles west of

Metaline Falls, 1,320 feet west of the southeast corner of sec. 31, T. 40 N., R. 43 E.

Oi-1 1/2 inches to 1 inch; needles and twigs; abrupt smooth boundary.
Oe-1 inch to 0; partially decomposed needles and twigs; abrupt smooth boundary.
E-0 to 1 inch; light gray (10YR 7/1) very fine sandy loam (volcanic ash), dark gray (10YR 4/1) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium and few coarse roots; many fine and medium pores; slightly acid; abrupt wavy boundary.
Bw1-1 to 5 inches; yellowish brown (10YR 5/4) silt loam, dark brown (7.5YR 3/4) moist; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many fine and medium and few coarse roots; many fine and medium pores; about 5 percent phyllite fragments; slightly acid; clear wavy boundary.
Bw2-5 to 12 inches; yellowish brown (10YR 5/4) silt loam, dark brown (7.5YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many fine and medium and few coarse roots; many fine and medium pores; about 5 percent phyllite fragments; neutral; clear wavy boundary.
Bw3-12 to 16 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many fine and medium and few coarse roots; many fine and medium pores; about 10 percent phyllite fragments; neutral; clear wavy boundary.
2C1-16 to 22 inches; very pale brown (10YR 7/3) channery loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine and medium pores; about 20 percent phyllite fragments and 5 percent flagstones; neutral; clear wavy boundary.
2C2-22 to 30 inches; very pale brown (10YR 7/3) very flaggy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine and medium pores; about 25 percent phyllite fragments and 20 percent flagstones; neutral; clear wavy boundary.
2R-30 inches; slightly weathered phyllite; some fines in fractures.

The mantle of volcanic ash and loess ranges from 14 to 22 inches in thickness. The depth to bedrock ranges from 20 to 40 inches. The control section is dominantly silt loam or loam in which the content of rock fragments is 35 to 60 percent. Reaction is moderately acid to neutral throughout the profile. Some pedons have a 2BC horizon.

The E horizon, if it occurs, has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 1 or 2 when dry and moist.

The Bw horizon has hue of 10YR, 7.5YR, or 5YR, value of 5 to 7 when dry and 3 or 4 when moist, and chroma of 2 to 4 when dry and moist. The texture is silt loam, loam, or channery loam. The content of rock fragments is 5 to 30 percent.

The 2C horizon has hue of 10YR or 2.5Y, value of 6 or 7 when dry and 3 to 5 when moist, and chroma of 2 to 4 when dry and moist. The fine-earth texture is silt loam or loam. The content of rock fragments is 20 to 75 percent.

Inkler Series

The Inkler series consists of very deep, well drained soils on foothills and mountains. These soils formed in glacial till and in residuum and colluvium derived dominantly from igneous or metamorphic rock. They have an admixture of volcanic ash and loess in the upper part. Slope is 0 to 65 percent. Elevation is 2,200 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 43 degrees F, the average growing season (at 28 degrees) is 90 to 120 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are loamy-skeletal, mixed, frigid Andic Xerochrepts.

Typical pedon of Inkler gravelly silt loam, 40 to 65 percent slopes, about 3.4 miles north and 1.5 miles west of lone, 2,200 feet north and 1,500 feet east of the southwest corner of sec. 13, T. 38 N., R. 42 E.

A-0 to 5 inches; grayish brown (10YR 5/2) gravelly silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; many fine and medium and few coarse roots; many fine pores; about 15 percent angular pebbles; neutral; clear wavy boundary.
Bw1-5 to 9 inches; pale brown (10YR 6/3) gravelly silt loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium and few coarse roots; many fine and medium pores; about 20 percent angular pebbles; neutral; clear wavy boundary.
Bw2-9 to 27 inches; light brownish gray (10YR 6/2)

very gravelly loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium and few coarse roots; many fine and medium pores; about 30 percent angular pebbles and 5 percent cobbles; neutral; clear wavy boundary.

2C1-27 to 38 inches; grayish brown (2.5Y 5/2) very gravelly loam, very dark grayish brown (2.5Y 3/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium and few coarse roots; many fine and medium pores; about 35 percent angular pebbles and 10 percent cobbles; slightly acid; clear wavy boundary.

2C2-38 to 42 inches; grayish brown (2.5Y 5/2) very gravelly loam, very dark grayish brown (2.5Y 3/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine and medium pores; about 40 percent pebbles and 15 percent cobbles; slightly acid; clear wavy boundary.

2C3-42 to 60 inches; light brownish gray (2.5Y 6/2) very gravelly loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; few fine and medium pores; about 40 percent pebbles and 15 percent cobbles; slightly acid.

The control section has more than 35 percent rock fragments. Reaction is slightly acid or neutral throughout the profile.

The A horizon, if it occurs, has value of 4 or 5 when dry and 2 or 3 when moist and chroma of 1 to 3 when dry and moist.

The Bw horizon has hue of 10YR or 2.5Y, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 2 or 3 when dry and moist. The texture is very gravelly loam, very gravelly silt loam, or gravelly silt loam.

The 2C horizon has hue of 5Y or 2.5Y, value of 5 to 7 when dry and 3 to 5 when moist, and chroma of 2 to 4 when dry and moist. The texture is very gravelly loam, very cobbly loam, very cobbly sandy loam, or very gravelly silt loam.

Kaniksu Series

The Kaniksu series consists of very deep, well drained soils on terraces and terrace escarpments. These soils formed in sandy glacial outwash of mixed mineralogy. The outwash has an admixture of volcanic ash and loess in the upper part. Slope is 0 to 40 percent. Elevation is 2,100 to 2,600 feet. The average annual precipitation is 25 to 32 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are sandy, mixed, frigid Vitrandic Xerochrepts.

Typical pedon of Kaniksu sandy loam, 0 to 15 percent slopes, about 2.25 miles south and 2.75 miles east of Scotia, 200 feet south and 1,300 feet west of the northeast corner of sec. 27, T. 30 N., R. 45 E.

Oe-1 inch to 0; partially decomposed organic litter of leaves, bark, twigs, and needles; abrupt smooth boundary.

A-0 to 7 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common fine tubular pores; slightly acid; clear wavy boundary.

Bw1-7 to 17 inches; light yellowish brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common fine roots; common fine tubular pores: slightly acid; clear wavy boundary.

Bw2-17 to 30 inches; light yellowish brown (10YR 6/4) sandy loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine tubular pores; about 5 percent pebbles: slightly acid; clear wavy boundary.

C1-30 to 40 inches; pale brown (10YR 6/3) gravelly loamy sand, dark yellowish brown (10YR 4/4) moist: massive; soft, very friable, nonsticky and nonplastic; few fine roots; about 15 percent pebbles; slightly acid; clear wavy boundary.

C2-40 to 60 inches; variegated gravelly loamy sand; a dominantly pale brown (10YR 6/3) matrix, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; about 15 percent pebbles; neutral.

The control section has less than 15 percent rounded rock fragments.

The A horizon has value of 5 or 6 when dry and 3 or 4 when moist and chroma of 2 or 3 when dry and moist. Reaction is neutral to moderately acid.

The Bw horizon has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 3 or 4 when dry and moist. The texture is sandy loam or fine sandy loam. Reaction is moderately acid to neutral.

The C horizon has value of 6 or 7 when dry and 4 or

5 when moist and chroma of 3 or 4 when dry and moist. The texture is gravelly loamy sand, gravelly sand, or loamy sand.

Kegel Series

The Kegel series consists of very deep, somewhat poorly drained soils on flood plains adjacent to streams. These soils formed in alluvium of mixed mineralogy. Slope is 0 to 3 percent. Elevation is 2,500 to 4,000 feet. The average annual precipitation is 22 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 80 to 100 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are coarse-loamy, mixed, frigid Fluvaquentic Haploxerolls.

Typical pedon of Kegel loam, about 5.6 miles north and 5.5 miles east of lone, 3,000 feet north and 2,500 feet east of the southwest corner of sec. 6, T. 38 N., R. 42 E.

Oe-1 inch to 0; partially decomposed organic litter of needles, leaves, bark, and cones; abrupt smooth boundary.

A1-0 to 12 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium and few coarse roots; many fine and medium pores; about 5 percent pebbles; neutral; clear wavy boundary.

A2-12 to 16 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium and few coarse roots; many fine and medium pores; about 10 percent pebbles; neutral; clear wavy boundary.

2C-16 to 20 inches; pale brown (10YR 6/3) gravelly sandy loam, dark brown (10YR 4/3) moist; common fine and medium distinct mottles, dark yellowish brown (10YR 3/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine and medium pores; about 15 percent pebbles; neutral; clear wavy boundary.

3Ab-20 to 30 inches; grayish brown (2.5Y 5/2) sandy loam, very dark grayish brown (2.5Y 3/2) moist; common fine and medium distinct mottles, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine and medium pores; about 10 percent pebbles; neutral; gradual wavy boundary.

4Cg-30 to 60 inches; light olive brown (2.5Y 5/4) very gravelly sandy loam, olive brown (2.5Y 4/4) moist; common fine and medium distinct mottles, dark brown (7.5YR 4/4) moist; single grain; loose; few fine roots; about 50 percent pebbles; neutral.

These soils are saturated below a depth of 6 to 24 inches in winter and spring. Reaction is slightly acid to moderately alkaline throughout the profile. The control section has less than 35 percent rock fragments.

The A horizon has value of 3 to 5 when dry and 1 or 2 when moist and chroma of 2 or 3 when dry and moist.

The 2C horizon has hue of 10YR, 7.5YR, or 2.5Y, value of 5 to 7 when dry and 3 to 6 when moist, and chroma of 2 to 4 when dry and moist. It is dominantly gravelly sandy loam or very gravelly sandy loam but in some pedons has lenses of very gravelly loamy sand.

The 3Ab horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 3 to 5 when dry and 2 to 4 when moist and chroma of 0 to 3 when dry and moist. It has few to many, fine to large, distinct mottles. The texture is silt loam, loam, or sandy loam.

The 4Cg horizon has hue of 2.5Y or 5Y, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. The texture is gravelly sandy loam, very gravelly sandy loam, very gravelly loamy sand, or very gravelly loamy coarse sand.

Kiehl Series

The Kiehl series consists of very deep, well drained soils on terraces. These soils formed in a thin mantle of volcanic ash and loess over glacial outwash of mixed mineralogy. Slope is 0 to 10 percent. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 120 days, and the frost-free period (at 32 degrees) is 75 to 105 days.

These soils are sandy-skeletal, mixed, frigid Andic Xerochrepts.

Typical pedon of Kiehl gravelly silt loam, 0 to 10 percent slopes, about 1 mile south and 0.5 mile west of Boundary Dam, 1,500 feet south and 300 feet east of the northwest corner of sec. 15, T. 40 N., R. 43 E.

Oe-2 inches to 0; partially decomposed leaves, twigs, and needles; abrupt smooth boundary.

A-0 to 5 inches; brown (10YR 5/3) gravelly silt loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very

fine and fine and few medium roots; about 25 percent pebbles; neutral; clear wavy boundary.

Bw1-5 to 12 inches; light yellowish brown (10YR 6/4) gravelly fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine and few medium roots; about 30 percent pebbles; neutral; clear wavy boundary.

Bw2-12 to 20 inches; light yellowish brown (10YR 6/4) gravelly fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many very fine and fine and few medium roots; about 25 percent pebbles and 10 percent cobbles; neutral; clear wavy boundary.

2C-20 to 60 inches; very pale brown (10YR 7/3) extremely gravelly loamy coarse sand, brown (10YR 5/3) moist; single grain; loose; few very fine and fine roots; about 45 percent pebbles, 25 percent cobbles, and 5 percent stones; neutral.

A thin layer of light colored volcanic ash is at the surface in some pedons.

The A horizon, if it occurs, has value of 4 or 5 when dry and 2 or 3 when moist and chroma of 2 or 3 when dry and moist.

The Bw horizon has hue of 7.5YR or 10YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. The fine-earth texture is silt loam, loam, or fine sandy loam. The content of pebbles and cobbles is 15 to 50 percent.

The 2C horizon has hue of 10YR or 2.5Y, value of 6 to 8 when dry and 4 to 6 when moist, and chroma of 3 or 4 when dry and moist. The texture is very gravelly loamy sand, very cobbly loamy sand, extremely gravelly loamy coarse sand, or extremely cobbly loamy coarse sand.

Manley Series

The Manley series consists of very deep, well drained soils on mountains. These soils formed in a thick mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slope is 0 to 65 percent. Elevation is 3,500 to 6,500 feet. The average annual precipitation is 28 to 45 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 80 to 90 days.

These soils are ashy over loamy-skeletal, mixed Xeric Vitricryands.

Typical pedon of Manley silt loam, 0 to 40 percent slopes, about 2 miles south and 6.5 miles west of Blueslide, 2,000 feet west of the northeast corner of sec. 22, T. 35 N., R. 42 E.

Oe-2 inches to 0; partially decomposed organic litter of needles, leaves, bark, and twigs; abrupt smooth boundary.

E-0 to 1/4 inch; light gray (10YR 7/2) very fine sandy loam (volcanic ash), grayish brown (10YR 5/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; common fine pores; slightly acid; abrupt smooth boundary.

Bw1-1/4 inch to 8 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many fine and medium and few coarse roots; many fine and medium pores; about 5 percent pebbles; moderately acid; clear smooth boundary.

Bw2-8 to 16 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; weak fine, medium, and coarse subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; common fine and medium roots; common fine and medium pores; about 10 percent pebbles; slightly acid; clear wavy boundary.

2C1-16 to 26 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few medium and coarse roots; few coarse pores; about 30 percent pebbles and 10 percent cobbles; neutral; clear wavy boundary.

2C2-26 to 60 inches; very pale brown (10YR 7/3) very gravelly sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few coarse roots; few fine irregular pores; about 35 percent pebbles and 20 percent cobbles; neutral.

The mantle of volcanic ash and loess ranges from 14 to 22 inches in thickness. The upper part of the control section has 30 to 60 percent pyroclastic material. Reaction is moderately acid to neutral throughout the profile. Some pedons are bouldery.

The E horizon, if it occurs, has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 1 or 2 when dry and moist. The content of rock fragments is 0 to 15 percent.

The Bw horizon has hue of 10YR or 7.5YR, value of 5 to 7 when dry and 3 to 5 when moist, and chroma of

3 or 4 when dry and moist. The texture is silt loam, loam, or fine sandy loam. The content of rock fragments is 0 to 15 percent.

The 2C horizon has hue of 10YR or 2.5Y, value of 6 or 7 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. The texture is very gravelly sandy loam, very cobbly loam, or extremely stony sandy loam.

Martella Series

The Martella series consists of very deep, moderately well drained soils on terraces. These soils formed in a mantle of volcanic ash and loess over silty glacial lake sediments. Slope is 0 to 40 percent. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 22 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are fine-silty, mixed, frigid Andic Haploxeralfs.

Typical pedon of Martella silt loam, 15 to 25 percent slopes, about 0.1 mile north and 1.5 miles east of lone, 600 feet north and 1,200 feet west of the southeast corner of sec. 32, T. 38 N.. R. 43 E.

Oe-1 1/2 inches to 0; partially decomposed organic litter of needles, leaves, and twigs; abrupt smooth boundary.

A1-0 to 1/4 inch; light gray (10YR 7/1) very fine sandy loam (volcanic ash), dark gray (10YR 4/1) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; slightly acid; abrupt smooth boundary.

A2-1/4 inch to 7 inches; pale brown (10YR 6/3) silt loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine, common medium, and few coarse roots; many very fine and fine pores; about 1 percent pebbles; neutral; clear wavy boundary.

Bw-7 to 13 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many fine, common medium, and few coarse roots; many very fine and fine pores; about 1 percent pebbles; neutral; abrupt smooth boundary.

2Bt-13 to 22 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; few fine, medium, and coarse roots; many very fine and fine pores; about 1 percent pebbles; neutral; abrupt wavy boundary.

2BC-22 to 32 inches; pale brown (10YR 6/3) very fine sandy loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; few very fine and fine pores; about 1 percent pebbles; neutral; clear wavy boundary.

2C1-32 to 39 inches; light yellowish brown (10YR 6/4) silt loam, dark brown (10YR 4/3) moist; massive and laminated; slightly hard, friable, slightly sticky and slightly plastic; few medium and coarse roots; few very fine and fine pores; about 1 percent pebbles; neutral; clear wavy boundary.

2C2-39 to 60 inches; light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; massive and laminated; hard, firm, slightly sticky and slightly plastic; few medium and coarse roots; few very fine and fine pores; about 1 percent pebbles; neutral.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. The control section has 18 to 35 percent clay and 0 to 5 percent rounded pebbles. Some pedons have a thin A horizon of loam or silt loam that is dark grayish brown (10YR 3/2) when moist.

The A1 horizon, if it occurs, has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 1 or 2 when dry and moist.

The A2 and Bw horizons have hue of 10YR or 7.5YR, value of 6 or 7 when dry and 3 to 5 when moist, and chroma of 3 or 4 when dry and moist. The texture is very fine sandy loam, silt loam, or loam. The content of pebbles is 0 to 5 percent. Reaction is neutral or slightly acid.

The 2Bt horizon has hue of 10YR or 2.5Y, value of 5 to 7 when dry and 4 or 5 when moist, and chroma of 2 to 4 when dry and moist. The texture is silt loam, very fine sandy loam, or silty clay loam. Reaction is slightly acid to mildly alkaline.

The 2C horizon has hue of 10YR. 2.5Y, or 5Y, value of 5 to 8 when dry and 4 to 6 when moist, and chroma of 2 to 4 when dry and moist. The texture is very fine sandy loam, silt loam, or silty clay loam. The content of pebbles is as much as 5 percent. Reaction is neutral or mildly alkaline.

Merkel Series

The Merkel series consists of very deep, well drained soils on foothills and mountains. These soils formed in glacial till derived dominantly from granitic rock. The till has an admixture of volcanic ash and loess in the upper part. Slope is 0 to 65 percent. Elevation is 2,500 to

4,500 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 43 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

These soils are loamy-skeletal, mixed, frigid Vitrandic Xerochrepts.

Typical pedon of Merkel stony sandy loam, 0 to 40 percent slopes, about 0.2 mile south and 0.75 mile west of lone, 1,000 feet south and 100 feet east of the northwest corner of sec. 1, T. 37 N., R. 42 E.

Oe-1 inch to 0; partially decomposed organic litter of needles, leaves, and twigs; clear wavy boundary.

E-0 to 1/2 inch; light gray (10YR 7/1) very fine sandy loam (volcanic ash), dark gray (10YR 4/1) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; slightly acid; abrupt smooth boundary.

Bw1-1/2 inch to 5 inches; light yellowish brown (10YR 6/4) stony sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; common fine, medium, and coarse roots; common fine and medium pores; about 15 percent pebbles, 5 percent cobbles, and 10 percent stones; slightly acid; clear wavy boundary.

Bw2-5 to 15 inches; light yellowish brown (10YR 6/4) stony sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; common fine and medium and few coarse roots; common fine and medium pores; about 15 percent pebbles, 5 percent cobbles, and 10 percent stones; slightly acid; clear wavy boundary.

2BC-15 to 23 inches; pale brown (10YR 6/3) very cobbly sandy loam, dark brown (10YR 4/3) moist; common medium faint mottles, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few fine, medium, and coarse roots; few fine and medium pores; about 25 percent pebbles and 20 percent cobbles; slightly acid; clear wavy boundary.

2C1-23 to 30 inches; very pale brown (10YR 7/3) very cobbly sandy loam, brown (10YR 5/3) moist; few medium faint mottles, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and nonplastic; few fine and medium roots; few fine and medium pores; about 30 percent pebbles, 20 percent cobbles, and 5 percent stones; slightly acid; clear wavy boundary.

2C2-30 to 60 inches; very pale brown (10YR 7/3) very cobbly coarse sandy loam, brown (10YR 5/3) moist; few medium faint mottles, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and nonplastic; few fine and medium roots; few fine and medium pores; about 25 percent pebbles and 25 percent cobbles; slightly acid.

The control section has 40 to 60 percent rock fragments. Some pedons have a surface layer of sandy loam or very stony sandy loam.

The E horizon, if it occurs, has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 1 or 2 when dry and moist.

The Bw horizon has value of 5 or 6 when dry and 3 or 4 when moist and chroma of 3 or 4 when dry and moist. The texture is stony or very stony sandy loam.

The 2BC horizon has value of 5 or 6 when dry and 3 or 4 when moist and chroma of 3 or 4 when dry and moist. The texture is very cobbly sandy loam or very cobbly coarse sandy loam.

The 2C horizon has hue of 10YR or 2.5Y, value of 6 or 7 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. The texture is very cobbly sandy loam, very cobbly coarse sandy loam, very cobbly loamy coarse sand, or very gravelly coarse sand.

Mobate Series

The Mobate series consists of shallow, well drained soils on foothills and mountains. These soils formed in residuum and colluvium derived dominantly from granitic rock. The residuum and colluvium have an admixture of volcanic ash and loess in the upper part. Slope is 0 to 65 percent. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 28 to 35 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 80 to 100 days.

These soils are loamy-skeletal, mixed, frigid, shallow Vitrandic Xerochrepts.

Typical pedon of Mobate gravelly loam, in an area of Mobate-Rock outcrop complex, 0 to 40 percent slopes, about 1 mile south and 2.5 miles east of Scotia, 300 feet north and 2,600 feet west of the southeast corner of sec. 15, T. 30 N., R. 45 E.

Oe-1 inch to 0; partially decomposed organic litter of needles, leaves, twigs, bark, and cones; abrupt smooth boundary.

A-0 to 4 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable, slightly sticky and nonplastic; many fine and medium roots; many fine and medium irregular

pores; about 15 percent pebbles; slightly acid; clear wavy boundary.

Bw-4 to 10 inches; pale brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few fine and medium roots; common fine pores; about 30 percent pebbles; slightly acid; clear wavy boundary.

BC-10 to 19 inches; very pale brown (10YR 7/3) very gravelly sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and nonplastic; few fine roots; few fine irregular pores; about 40 percent pebbles; slightly acid; clear wavy boundary.

Cr-19 inches; slightly weathered granite.

The depth to weathered bedrock ranges from 10 to 20 inches. Reaction is slightly acid or neutral throughout the profile.

The A horizon has value of 4 or 5 when dry and 2 or 3 when moist and chroma of 2 or 3 when dry and moist. It has 10 to 25 percent pebbles.

The Bw horizon has value of 5 or 6 when dry and 3 or 4 when moist and chroma of 3 or 4 when dry and moist. The texture is gravelly loam or gravelly sandy loam.

The BC horizon has value of 5 to 7 when dry and 4 or 5 when moist and chroma of 3 or 4 when dry and moist. The texture is very gravelly sandy loam or very gravelly loam.

Moscow Series

The Moscow series consists of moderately deep, well drained soils on foothills and mountains. These soils formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from granitic rock. Slope is 0 to 65 percent. Elevation is 2,200 to 4,000 feet. The average annual precipitation is 27 to 30 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 80 to 100 days, and the frost-free period (at 32 degrees) is 75 to 105 days.

These soils are coarse-loamy, mixed, frigid Andic Xerochrepts.

Typical pedon of Moscow silt loam, 0 to 25 percent slopes, about 2.75 miles south and 2.75 miles east of Scotia, 1,320 feet north and 1,320 feet west of the southeast corner of sec. 27, T. 30 N., R. 45 E.

Oe-1 1/2 inches to 0; partially decomposed organic litter of needles, twigs, and cones; abrupt smooth boundary.

A-0 to 8 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; weak very fine and fine granular structure; soft, very friable, slightly sticky and nonplastic; many very fine, fine, and medium and common coarse roots; common very fine discontinuous irregular pores; about 2 percent pebbles; slightly acid; gradual wavy boundary.

Bw-8 to 12 inches; yellowish brown (10YR 5/4) silt loam, dark brown (10YR 4/3) moist; weak very fine and fine granular structure; soft, very friable, slightly sticky and nonplastic; many fine, medium, and coarse roots; common very fine discontinuous irregular pores; about 5 percent pebbles; slightly acid; clear wavy boundary.

2BC-12 to 27 inches; light yellowish brown (10YR 6/4) gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine and few medium and coarse roots; common very fine and fine discontinuous irregular pores; about 20 percent pebbles; slightly acid; abrupt smooth boundary.

2Cr-27 inches; variegated white, gray, and very pale brown (10YR 8/2, 6/1, 7/4), decomposed granite that has thin mica flakes; massive but crushes to gravel and coarse sand; very hard, very firm; few roots; clearly evident rock structure; slightly acid.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. The depth to weathered bedrock ranges from 20 to 40 inches. The control section has 5 to 35 percent granitic pebbles. Reaction is strongly acid to neutral throughout the profile. Some pedons have a thin layer of light colored volcanic ash at the surface. Some have a 2C horizon.

The A horizon has value of 5 or 6 when dry and 2 to 4 when moist and chroma of 2 or 3 when dry and moist.

The Bw horizon has hue of 7.5YR or 10YR, value of 5 or 6 when dry and 3 to 5 when moist, and chroma of 3 or 4 when dry and moist. The texture is loam or silt loam. The content of pebbles is 2 to 15 percent.

The 2BC horizon has value of 5 to 7 when dry and 4 or 5 when moist and chroma of 3 or 4 when dry and moist. The fine-earth texture is sandy loam or coarse sandy loam. The content of rock fragments is 15 to 30 percent.

Moso Series

The Moso series consists of deep, well drained soils on foothills and mountains. These soils formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from granitic rock, gneiss, and schist. Slope is 0 to 40 percent. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 25 to

38 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are coarse-loamy, mixed, frigid Andic Xerochrepts.

Typical pedon of Moso silt loam, 0 to 25 percent slopes, about 3 miles west of the south end of Sacheen Lake, 1,200 feet south and 300 feet west of the northeast corner of sec. 32, T. 31 N., R. 43 E.

Oe-1 1/2 inches to 0; partially decomposed organic litter of needles, leaves, twigs, bark, cones, and grasses; abrupt smooth boundary.

A-0 to 2 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; about 1 percent pebbles; moderately acid; clear wavy boundary.

Bw1-2 to 8 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine and few medium roots; about 2 percent pebbles; moderately acid; clear wavy boundary.

Bw2-8 to 12 inches; light yellowish brown (10YR 6/4) loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine and few medium roots; about 5 percent pebbles; slightly acid; clear wavy boundary.

2BC-12 to 35 inches; pale brown (10YR 6/3) gravelly sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and nonplastic; few very fine and fine roots; about 20 percent pebbles; moderately acid; clear wavy boundary.

2C-35 to 48 inches; light brownish gray (2.5Y 6/2) very gravelly loamy coarse sand, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine and fine roots; about 50 percent pebbles; moderately acid; clear wavy boundary.

2Cr-48 inches; weathered granite.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. The depth to weathered bedrock ranges from 40 to 60 inches. The control section has 5 to 35 percent angular granitic pebbles. A thin layer of light colored volcanic ash is at the surface in some pedons.

The A horizon, if it occurs, has value of 5 or 6 when dry and 3 or 4 when moist and chroma of 2 or 3 when dry and moist. Reaction is slightly acid to strongly acid.

The Bw horizon has hue of 10YR or 7.5YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. The fine-earth texture is silt loam, loam, or sandy loam. The content of pebbles is 2 to 20 percent. Reaction is slightly acid to strongly acid.

The 2BC horizon has hue of 10YR or 2.5Y, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 2 to 4 when dry and moist. The texture is gravelly sandy loam, sandy loam, or loam. The content of pebbles is 5 to 25 percent. Reaction is slightly acid or moderately acid.

The 2C horizon has hue of 10YR or 2.5Y, value of 5 to 7 when dry and 4 to 6 when moist, and chroma of 2 or 3 when dry and moist. The texture is very gravelly loamy coarse sand or very gravelly coarse sand. The content of pebbles is 35 to 50 percent. Reaction is slightly acid or moderately acid.

Newbell Series

The Newbell series consists of very deep, well drained soils on foothills and mountains. These soils formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slope is 0 to 65 percent. Elevation is 2,500 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 120 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are loamy-skeletal, mixed, frigid Andic Xerochrepts.

Typical pedon of Newbell silt loam, 0 to 25 percent slopes, about 1 mile south and 1 mile east of Nile Lake, 1,000 feet north of the southwest corner of sec. 1, T. 36 N., R. 42 E.

Oe-1 inch to 0; partially decomposed needles, twigs, cones, and grasses; abrupt smooth boundary.

A-0 to 6 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many fine and medium and few coarse roots; common very fine and fine pores; about 5 percent pebbles; neutral; clear wavy boundary.

Bw-6 to 12 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many fine and medium and few coarse roots; common very fine and fine pores;

about 8 percent pebbles; slightly acid; clear wavy boundary.

2BC-12 to 18 inches; very pale brown (10YR 7/3) very gravelly sandy loam, brown (10YR 5/3) moist; few fine distinct mottles, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common very fine and fine pores; about 40 percent pebbles and 5 percent cobbles; slightly acid; clear wavy boundary.

2C-18 to 26 inches; light gray (2.5Y 7/2) very gravelly sandy loam, grayish brown (2.5Y 5/2) moist; few fine distinct mottles, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine and very fine pores; about 40 percent pebbles and 5 percent cobbles; slightly acid; clear wavy boundary.

2Cd-26 to 60 inches; light gray (2.5Y 7/2) very gravelly sandy loam, grayish brown (2.5Y 5/2) moist; few fine distinct mottles, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; few very fine and fine pores; about 40 percent pebbles and 10 percent cobbles; slightly acid.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. The control section has 35 to 60 percent rock fragments. Reaction is neutral to moderately acid throughout the profile. Some pedons have a thin layer of light colored volcanic ash at the surface. Some are stony or very bouldery to a depth of about 12 inches.

The A horizon, if it occurs, has value of 4 or 5 when dry and 3 or 4 when moist and chroma of 2 to 4 when dry and moist.

The Bw horizon has hue of 10YR or 7.5YR, value of 5 to 7 when dry and 3 to 5 when moist, and chroma of 3 to 6 when dry and moist. The texture is silt loam or loam. The content of pebbles is 5 to 15 percent.

The 2BC horizon has hue of 10YR or 2.5Y, value of 5 to 7 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. The texture is very gravelly loam or very gravelly sandy loam.

The 2C horizon has hue of 2.5Y or 10YR, value of 5 to 7 when dry and 4 to 6 when moist, and chroma of 2 or 3 when dry and moist. In some pedons it is mottled. The texture is very gravelly loam or very gravelly sandy loam.

Ojibway Series

The Ojibway series consists of moderately deep, well drained soils on foothills and mountains. These soils formed in residuum and colluvium derived dominantly from amphibolite. The residuum and colluvium have an admixture of volcanic ash and loess. Slope is 30 to 65 percent. Elevation is 2,600 to 4,750 feet. The average annual precipitation is 30 to 45 inches, the average annual air temperature is about 44 degrees F, and the average growing season (at 28 degrees) is 90 to 110 days.

These soils are coarse-loamy, mixed, frigid Vitrandic Xerochrepts.

Typical pedon of Ojibway gravelly loam, 40 to 65 percent slopes, about 6 miles north and 2.1 miles west of Newport, 350 feet north and 600 feet west of the southeast corner of sec. 15, T. 32 N., R. 45 E.

Oe-2 inches to 0; partially decomposed organic litter of needles, leaves, bark, moss, and twigs; abrupt smooth boundary.

A1-0 to 1/2 inch; light gray (2.5Y 7/2) very fine sandy loam (volcanic ash), grayish brown (2.5Y 5/2) moist; weak very fine and fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; neutral; abrupt smooth boundary.

A2-1/2 inch to 5 inches; dark brown (7.5YR 4/4) gravelly loam, dark reddish brown (5YR 3/2) moist; weak medium granular and weak fine subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; common very fine, fine, medium, and coarse roots; about 25 percent angular pebbles and 5 percent angular cobbles; slightly acid; clear wavy boundary.

Bw1-5 to 11 inches; dark brown (7.5YR 4/4) very gravelly loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; common very fine, fine, medium, and coarse roots; about 35 percent angular pebbles, 10 percent angular cobbles, and 5 percent angular and subangular saprolitic fragments; slightly acid; clear wavy boundary.

Bw2-11 to 17 inches; strong brown (7.5YR 5/6) gravelly loam, dark brown (7.5YR 4/4) moist; moderate fine subangular blocky and moderate medium and coarse granular structure; hard, firm, nonsticky and slightly plastic; common very fine and fine roots; about 20 percent angular pebbles, 10 percent angular cobbles, and 25 percent angular and subangular saprolitic fragments; slightly acid; clear wavy boundary.

Bw3-17 to 23 inches; strong brown (7.5YR 5/6) gravelly sandy loam, dark brown (7.5YR 4/4) moist; moderate fine subangular blocky and moderate medium and coarse granular structure; hard, firm, nonsticky and slightly plastic; few very fine, fine,

and medium roots; about 15 percent angular pebbles, 5 percent cobbles, and 40 percent angular and subangular saprolitic fragments; moderately acid; abrupt wavy boundary.

Cr-23 inches; weathered amphibolite; few very fine, fine, and medium roots; many thick clay films along fracture planes.

The depth to weathered bedrock ranges from 20 to 40 inches. The content of hard quartzite and amphibolite rock fragments generally is 20 to 35 percent in the control section, but in some horizons it is as much as 45 percent. Reaction is slightly acid or moderately acid throughout the profile.

The A1 horizon, if it occurs, has value of 6 or 7 when dry and 5 or 6 when moist and chroma of 1 or 2 when dry and moist. The A2 horizon has hue of 7.5YR or 5YR, value of 3 or 4 when dry, and chroma of 3 or 4 when dry and 2 or 3 when moist.

The Bw horizon has hue of 5YR or 7.5YR, value of 4 or 5 when dry and 3 or 4 when moist, and chroma of 4 to 6 when dry and moist. The fine-earth texture is loam or sandy loam. The content of hard rock fragments is 20 to 45 percent.

Orwig Series

The Orwig series consists of very deep, well drained soils on terraces and terrace escarpments. These soils formed in sandy glacial outwash derived dominantly from granitic rock. The outwash has an admixture of volcanic ash and loess in the upper part. Slope is 0 to 65 percent. Elevation is 2,000 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are sandy, mixed, frigid Vitrandic Xerochrepts.

Typical pedon of Orwig sandy loam, 0 to 20 percent slopes, about 0.3 mile south and 5.25 miles west of Blueslide, 1,800 feet south and 1,200 feet west of the northeast corner of sec. 11, T. 35 N., R. 42 E.

Oe-2 inches to 0; partially decomposed organic litter of needles, leaves, twigs, bark, and cones; abrupt smooth boundary.

E-0 to 1/4 inch; light gray (2.5Y 7/2) very fine sandy loam (volcanic ash), grayish brown (2.5Y 5/2) moist; weak *very* fine granular structure; soft, very friable, nonsticky and nonplastic; common roots; slightly acid; abrupt smooth boundary.

Bw1-1/4 inch to 4 inches:, light yellowish brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and nonplastic; many very fine and fine, common medium, and few coarse roots; few very fine and fine discontinuous pores; slightly acid; clear wavy boundary.

Bw2-4 to 9 inches; light yellowish brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; few very fine and fine discontinuous pores; slightly acid; clear wavy boundary.

BC-9 to 18 inches; very pale brown (10YR 7/4) sandy loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many very fine and fine and few medium and coarse roots; few very fine and fine discontinuous pores; about 5 percent angular granitic pebbles; slightly acid; clear wavy boundary.

C1-18 to 27 inches; very pale brown (10YR 8/3) loamy sand, pale brown (10YR 6/3) moist; common fine and medium distinct stains, strong brown (7.5YR 516) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; about 10 percent angular granitic pebbles; slightly acid; clear wavy boundary.

C2-27 to 60 inches; very pale brown (10YR 8/3) gravelly sand, pale brown (10YR 6/3) moist; few fine and medium distinct stains, strong brown (7.5YR 5/6) moist; single grain; loose; few very fine and fine roots; about 15 percent angular granitic pebbles; slightly acid.

The control section has 5 to 20 percent angular granitic pebbles. Reaction is slightly acid or neutral throughout the profile.

The E horizon, if it occurs, has hue of 2.5Y or 10YR, value of 6 or 7 when dry and 4 or 5 when moist, and chroma of 1 or 2 when dry and moist.

The Bw horizon has value of 6 or 7 when dry and 3 to 5 when moist and chroma of 3 or 4 when dry and moist. The texture is sandy loam or fine sandy loam. The content of pebbles is as much as 10 percent.

The BC horizon has value of 7 or 8 when dry and 5 or 6 when moist and chroma of 3 or 4 when dry and moist. The texture is sandy loam or fine sandy loam. The content of angular granitic pebbles is 5 to 10 percent.

The C horizon has hue of 10YR or 2.5Y, value of 7 or 8 when dry and 5 or 6 when moist, and chroma of 2

to 4 when dry and moist. It has stains in most pedons. The texture is sand, gravelly sand, or loamy sand. The content of angular granitic pebbles is 10 to 25 percent.

Prouty Series

The Prouty series consists of moderately deep, well drained soils on mountains. These soils formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from granitic rock. Slope is 30 to 65 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 45 to 55 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 70 to 90 days.

These soils are loamy-skeletal, mixed Andic Cryochrepts.

Typical pedon of Prouty extremely bouldery silt loam, in an area of Prouty-Rock outcrop complex, 30 to 65 percent slopes, about 3.75 miles south and 11 miles east of lone, 500 feet north and 500 feet east of the southwest corner of sec. 24, T. 37 N., R. 44 E.

Oe-1 inch to 0; partially decomposed organic litter of leaves, twigs, bark, and needles; abrupt smooth boundary.

A-0 to 7 inches; yellowish brown (10YR 5/4) extremely bouldery silt loam, dark yellowish brown (10YR 3/4) moist; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; common fine and medium roots; common discontinuous pores; about 10 percent pebbles and 5 percent boulders; moderately acid; clear wavy boundary.

Bw-7 to 13 inches; light yellowish brown (10YR 6/4) gravelly silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; common fine and medium roots; discontinuous irregular pores; about 20 percent pebbles; moderately acid; abrupt wavy boundary.

2BC-13 to 17 inches; very pale brown (10YR 7/4) gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few fine and medium roots; few discontinuous pores; about 30 percent pebbles; moderately acid; clear wavy boundary.

2C-17 to 28 inches; very pale brown (10YR 7/4) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky and nonplastic; few fine and medium roots; few discontinuous pores; about 50 percent pebbles; moderately acid; clear wavy boundary.

2Cr-28 inches; yellow, white, and black, weathered granite.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. The depth to weathered bedrock ranges from 20 to 40 inches. The control section has 35 to 60 percent rock fragments. Reaction is moderately acid or strongly acid throughout the profile. A thin layer of light colored volcanic ash is at the surface in some pedons.

The A and Bw horizons have hue of 7.5YR or 10YR, value of 5 to 7 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist.

The 2BC horizon has hue of 7.5YR or 10YR, value of 6 or 7 when dry and 4 or 5 when moist, and chroma of 4 to 6 when dry and moist. The texture is gravelly sandy loam, gravelly coarse sandy loam, very gravelly sandy loam, or very gravelly coarse sandy loam.

The 2C horizon has hue of 10YR or 2.5Y, value of 5 to 7 when dry and 4 to 6 when moist, and chroma of 4 or 5 when dry and moist. The texture is very gravelly sandy loam, very gravelly coarse sandy loam, very cobbly sandy loam, extremely stony sandy loam, or very cobbly coarse sandy loam.

Prouty Variant

The Prouty Variant consists of moderately deep, well drained soils on mountains. These soils formed in a mantle of volcanic ash and loess over residuum and colluvium derived dominantly from limestone. Slope is 5 to 65 percent. Elevation is 4,400 to 5,500 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is about 38 degrees F, and the average growing season (at 28 degrees) is 60 to 90 days.

These soils are loamy-skeletal, mixed Andic Cryochrepts.

Typical pedon of Prouty Variant silt loam, 30 to 65 percent slopes, about 0.4 mile south and 6.75 miles east of Boundary Dam, 2,100 feet north and 800 feet west of the southeast corner of sec. 11, T. 40 N., R. 44 E.

Oe-1 inch to 0; partially decomposed needles, twigs, bark, moss, and lichens:, abrupt smooth boundary.

E-0 to 1/4 inch; gray (10YR 6/1) very fine sandy loam (volcanic ash), dark gray (10YR 4/1) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and medium roots; about 5 percent angular pebbles; neutral; abrupt broken boundary.

Bw1-1/4 inch to 2 inches; strong brown (7.5YR 5/6) silt loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky and weak fine and medium

granular structure:, slightly hard, friable, nonsticky and nonplastic; moderately smeary; many medium and coarse and common very fine and fine roots; about 10 percent angular pebbles; neutral; abrupt wavy boundary.

Bw2-2 to 10 inches; strong brown (7.5YR 5/6) silt loam, dark brown (7.5YR 3/4) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; moderately smeary; common very fine, fine, medium, and coarse roots; about 10 percent angular pebbles; neutral; clear wavy boundary.

2BC-10 to 13 inches; yellowish brown (10YR 5/6) gravelly silt loam, strong brown (7.5YR 3/6) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; moderately smeary; common very fine, fine, medium, and coarse roots; about 15 percent angular pebbles; neutral; abrupt wavy boundary.

2C-13 to 30 inches; light olive brown (2.5Y 5/4) extremely gravelly sandy loam, olive brown (2.5Y 4/4) moist; massive; loose; few very fine and fine and common medium and coarse roots; about 70 percent angular pebbles; mildly alkaline; clear wavy boundary.

2R-30 inches; limestone.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. The depth to bedrock ranges from 20 to 40 inches. The control section has 35 to 80 percent angular rock fragments.

The E horizon, if it occurs, has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 1 or 2 when dry and moist.

The Bw horizon has hue of 5YR or 7.5YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 to 6 when dry and moist. The texture is loam or silt loam. The content of angular pebbles is 0 to 10 percent.

The 2BC horizon has hue of 7.5YR or 10YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 4 to 6 when dry and moist. The texture is gravelly silt loam or gravelly loam. Reaction is neutral or mildly alkaline.

The 2C horizon has hue of 10YR or 2.5Y, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. The texture is very gravelly loam, very gravelly sandy loam, extremely gravelly loam, or extremely gravelly sandy loam. Reaction is neutral or mildly alkaline.

Pywell Series

The Pywell series consists of very deep, very poorly drained, organic soils in depressions on flood plains, in old lake basins, and on the perimeter of lakes. These soils formed in organic material derived dominantly from herbaceous plants. Slope is 0 to 3 percent. Elevation is 1,900 to 2,800 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 45 degrees F, and the average growing season (at 28 degrees) is 80 to 110 days.

These soils are Euic Typic Borosaprists.

Typical pedon of Pywell muck, about 2.5 miles south and 3.25 miles east of Scotia, 2,600 feet south and 300 feet east of the northwest corner of sec. 26, T. 30 N., R. 45 E.

Op-0 to 10 inches; muck, black (10YR 2/1) broken face and rubbed; about 15 percent fibers, 5 percent rubbed; moderate coarse subangular blocky structure; many fine roots; strongly acid; abrupt smooth boundary.

Oa1-10 to 16 inches; muck, very dark gray (10YR 3/1) broken face and rubbed; about 25 percent fibers, 10 percent rubbed; moderate coarse subangular blocky structure; many fine roots; strongly acid; abrupt wavy boundary.

Oa2-16 to 36 inches; muck, very dark grayish brown (10YR 3/2) broken face and rubbed; about 25 percent fibers, 10 percent rubbed; massive; few fine roots; few lenses of volcanic ash ^{1}/8 inch thick; strongly acid; abrupt wavy boundary.

Oa3-36 to 42 inches; muck, black (10YR 2/1) broken face and rubbed; about 20 percent fibers, 10 percent rubbed; massive; few fine roots; thin lenses of volcanic ash 1/8 inch thick; strongly acid; abrupt wavy boundary.

Oa4-42 to 60 inches; muck, black (10YR/2/1) broken face and rubbed; about 25 percent fibers, 10 percent rubbed; massive; lenses of volcanic ash 1/8 to 1/4 inch thick; strongly acid.

The organic material is more than 52 inches thick. Some pedons have as much as 30 percent woody material. Reaction is strongly acid to neutral throughout the profile.

The surface tier is predominantly sapric material, but some pedons have thin layers of hemic material. This tier has hue of 10YR or 7.5YR, value of 2 or 3 when moist, and chroma of 1 to 3 when moist.

The subsurface tier is primarily sapric material, but some pedons have thin lenses of volcanic ash or hemic material. This tier has hue of 10YR or 7.5YR, value of 2 to 4 when moist, and chroma of 1 to 3 when moist.

The bottom tiers are dominantly sapric material, but some pedons have lenses of volcanic ash and varying amounts of woody or herbaceous fibers. These tiers have hue of 7.5YR or 10YR, value of 2 or 3 when moist, and chroma of 1 or 2 when moist.

Raisio Series

The Raisio series consists of moderately deep, well drained soils on south- and west-facing slopes on foothills and mountains. These soils formed in residuum and colluvium derived dominantly from metasedimentary rock, including shale, argillite, phyllite, and slate. The residuum and colluvium have an admixture of volcanic ash and loess. In some areas the soils are modified by glacial till. Slope is 10 to 65 percent. Elevation is 2,000 to 4,500 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 47 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

These soils are loamy-skeletal, mixed, mesic Vitrandic Haploxerolls.

Typical pedon of Raisio channery loam, 40 to 65 percent slopes, about 0.5 mile north and 0.25 mile west of Browns Lake campground, 1,200 feet north and 1,400 feet west of the southeast corner of sec. 14, T. 34 N., R. 44 E.

Oi-1 inch to 0; loose organic litter of needles, bark, twigs, and grasses; abrupt smooth boundary.

A-0 to 5 inches; grayish brown (10YR 5/2) channery loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium and few coarse roots; many fine pores; about 20 percent channers; neutral; clear wavy boundary.

Bw-5 to 9 inches; brown (10YR 5/3) very flaggy loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium and few coarse roots; many fine pores; about 25 percent channers and 25 percent flagstones; neutral; clear wavy boundary.

C1-9 to 26 inches; pale brown (10YR 6/3) extremely flaggy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; few fine pores; about 20 percent channers and 40 percent flagstones; neutral; clear wavy boundary.

C2-26 to 36 inches; light brownish gray (2.5Y 6/2) extremely flaggy loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine pores; about 30 percent channers and 30 percent flagstones; neutral; abrupt wavy boundary.

R-36 inches; phyllite.

The depth to bedrock ranges from 20 to 40 inches. The control section has 35 to 80 percent channers and flagstones. Reaction is neutral or slightly acid throughout the profile.

The A horizon has value of 4 or 5 when dry and 2 or 3 when moist and chroma of 2 or 3 when dry and moist. The fine-earth texture is loam or sandy loam. The content of channers is 35 to 60 percent.

The C horizon has hue of 10YR or 2.5Y, value of 6 or 7 when dry and 4 or 5 when moist, and chroma of 2 or 3 when dry and moist. The fine-earth texture is loam or sandy loam. The content of channers is 50 to 80 percent.

Rathdrum Series

The Rathdrum series consists of very deep, well drained soils in depressions on outwash plains and terraces adjacent to perennial streams. These soils formed in alluvium derived dominantly from volcanic ash and loess over glacial outwash. Slope is 0 to 3 percent. Elevation is 2,000 to 2,600 feet. The average annual precipitation is 25 to 32 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are ashy, frigid Typic Vitrixerands.

Typical pedon of Rathdrum very fine sandy loam, about 1.4 miles south and 3.75 miles west of Newport, 2,200 feet south and 100 feet east of the northwest corner of sec. 27, T. 31 N., R. 45 E.

Oe-1 inch to 0; partially decomposed organic litter of leaves, twigs, bark, and needles; abrupt smooth boundary.

A-0 to 6 inches; pale brown (10YR 6/3) very fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine and few medium roots; slightly acid; clear wavy boundary.

Bw1-6 to 14 inches; pale brown (10YR 6/3) very fine sandy loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many *very* fine and fine and few medium roots; slightly acid; clear wavy boundary.

Bw2-14 to 22 inches; pale brown (10YR 6/3) very fine sandy loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine and few medium roots; slightly acid; clear wavy boundary.

C1-22 to 30 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive;

soft, very friable, slightly sticky and nonplastic; weakly smeary; few very fine, fine, and medium roots; neutral; clear wavy boundary.

C2-30 to 42 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky and nonplastic; weakly smeary; few very fine, fine, and medium roots; about 5 percent pebbles; neutral; clear wavy boundary.

C3-42 to 60 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky and nonplastic; few very fine, fine, and medium roots; about 10 percent pebbles; neutral.

The control section has more than 60 percent pyroclastic material. Reaction is neutral to moderately acid throughout the profile. A thin layer of light colored volcanic ash is at the surface in some pedons.

The A horizon, if it occurs, and the Bw horizon have hue of 10YR or 7.5YR, value of 6 or 7 when dry and 3 to 5 when moist, and chroma of 3 or 4 when dry and moist. The Bw horizon is very fine sandy loam or silt loam.

The C horizon has value of 6 to 8 when dry and 4 to 6 when moist and chroma of 3 or 4 when dry and moist. The texture is very fine sandy loam, fine sandy loam, or silt loam. This horizon has rock fragments in some pedons.

Roaring Series

The Roaring series consists of very deep, well drained soils on glacial outwash terraces and escarpments. These soils formed in a mantle of volcanic ash and loess over sandy outwash derived mainly from granitic rock. Slope is 5 to 65 percent. Elevation is 3,500 to 6,000 feet. The average annual precipitation is 35 to 45 inches, the average annual air temperature is about 38 degrees F, and the average growing season (at 28 degrees) is 60 to 90 days.

These soils are coarse-loamy, mixed Andic Cryochrepts.

Typical pedon of Roaring silt loam, 30 to 65 percent slopes, about 4.75 miles east and 2.75 miles south of lone, 300 feet west and 100 feet north of the southeast corner of sec. 14, T. 37 N., R. 43 E.

Oi&Oe-2 inches to 0; loose, unweathered and partially decomposed organic litter of needles, leaves, twigs, bark, and cones, very dark grayish brown (10YR 3/2) moist; abrupt smooth boundary.

E-0 to 1/4 inch; light gray (10YR 7/1) very fine sandy loam, gray (10YR 5/1) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; slightly acid; abrupt wavy boundary.

Bw1-1/4 inch to 4 inches; brown (10YR 5/3) silt loam, dark brown (7.5YR 3/4) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine and few medium and coarse roots; many very fine and fine pores; slightly acid; clear wavy boundary.

Bw2-4 to 12 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine and few medium and coarse roots; many very fine and fine pores; about 5 percent pebbles; slightly acid; clear wavy boundary.

2BC1-12 to 18 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine and few medium and coarse roots; many very fine and fine pores; about 5 percent pebbles; slightly acid; clear wavy boundary.

2BC2-18 to 28 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine and few medium and coarse roots; common very fine and fine pores; about 5 percent pebbles; slightly acid; clear wavy boundary.

2C1-28 to 36 inches; light gray (2.5Y 7/2) gravelly loamy coarse sand, grayish brown (2.5Y 5/2) moist; single grain; loose, nonsticky and nonplastic; few very fine, fine, medium, and coarse roots; about 25 percent pebbles; slightly acid; clear wavy boundary.

2C2-36 to 57 inches; light gray (2.5Y 7/2) gravelly loamy coarse sand, grayish brown (2.5Y 5/2) moist; single grain; loose; few very fine and fine roots; about 30 percent pebbles; slightly acid; clear wavy boundary.

2C3-57 to 60 inches; light gray (2.5Y 7/2) very gravelly loamy fine sand, grayish brown (2.5Y 5/2) moist; single grain; loose; few very fine and fine roots; about 35 percent pebbles; slightly acid.

The control section has 0 to 35 percent coarse fragments. Reaction is neutral or slightly acid throughout the profile.

The E horizon has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 1 or 2 when dry and moist.

The Bw horizon has hue of 10YR or 7.5YR, value of 5 to 7 when dry and 3 to 5 when moist, and chroma of

2 to 4 when dry and moist. The texture is silt loam, loam, or sandy loam. The content of pebbles is 0 to 10 percent.

The 2BC horizon has value of 5 to 7 when dry and 3 to 5 when moist and chroma of 2 to 4 when dry and moist. The content of pebbles is 0 to 10 percent.

The 2C horizon has hue of 2.5Y or 10YR, value of 6 or 7 when dry and 4 to 6 when moist, and chroma of 2 to 4 when dry and moist. The texture is gravelly loamy coarse sand, gravelly loamy fine sand, gravelly loamy sand, very gravelly loamy fine sand, or very gravelly loamy coarse sand. The content of coarse fragments is 25 to 35 percent in the upper part of this horizon and 25 to 45 percent in the lower part.

Rufus Series

The Rufus series consists of shallow, well drained soils on south- and west-facing slopes on foothills and mountains. These soils formed in colluvium and residuum derived dominantly from metasedimentary rock, including shale, argillite, phyllite, and slate. The residuum and colluvium have an admixture of volcanic ash and loess. In some areas the soils are modified by glacial till. Slope is 30 to 65 percent. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 25 to 30 inches, the average annual air temperature is about 46 degrees F, and the average growing season (at 28 degrees) is 90 to 120 days.

These soils are loamy-skeletal, mixed, mesic Lithic Ultic Haploxerolls.

Typical pedon of Rufus channery loam, 30 to 65 percent slopes, about 0.3 mile north and 1.75 miles west of Browns Lake campground, 900 feet north and 680 feet east of the southwest corner of sec. 15, T. 34 N., R. 44 E.

A1-0 to 4 inches; dark grayish brown (10YR 4/2) channery loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; about 30 percent channers; neutral; clear wavy boundary.

A2-4 to 12 inches; brown (10YR 5/3) very flaggy loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; about 25 percent channers and 25 percent flagstones; neutral; clear wavy boundary.

AC-12 to 14 inches; pale brown (10YR 6/3) extremely flaggy loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few *very* fine, fine, and medium roots; about 25 percent channers and 40 percent flagstones; neutral; abrupt wavy boundary.

R-14 inches; phyllite.

The depth to bedrock ranges from 10 to 20 inches. The control section has 35 to 80 percent rock fragments.

The A1 and A2 horizons have value of 4 or 5 when dry and 2 or 3 when moist and chroma of 2 or 3 when dry and moist. The A2 horizon is very flaggy or extremely flaggy loam. It is neutral or slightly acid.

The AC horizon has hue of 10YR or 2.5Y, value of 5 or 6 when dry and 3 to 5 when moist, and chroma of 2 or 3 when dry and moist. The texture is extremely flaggy loam or very flaggy loam. Reaction is neutral or slightly acid.

Sacheen Series

The Sacheen series consists of very deep, somewhat excessively drained soils on terraces and old alluvial fans. These soils formed in sandy glaciofluvial material of mixed mineralogy. Slope is 5 to 25 percent. Elevation is 2,000 to 3,400 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are mixed, frigid Typic Xeropsamments.

Typical pedon of Sacheen loamy fine sand, 15 to 25 percent slopes, about 2.5 miles south and 2.1 miles east of Newport, 2,600 feet south and 200 feet west of the northeast corner of sec. 34, T. 31 N., R. 45 E.

Oe-1 inch to 0; partially decomposed organic litter of needles, leaves, and twigs; abrupt smooth boundary.

A-0 to 6 inches; dark brown (10YR 3/3) loamy fine sand, *very* dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many medium and few fine and coarse roots; common very fine discontinuous pores; moderately acid; clear wavy boundary.

Bw-6 to 12 inches; dark brown (10YR 4/3) loamy fine sand, dark brown (10YR 3/3) moist; weak fine, medium, and coarse subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine, medium, and coarse roots; common very fine discontinuous pores; moderately acid; abrupt smooth boundary.

BC-12 to 24 inches; yellowish brown (10YR 5/4) loamy sand, dark brown (10YR 4/3) moist; weak medium

and coarse subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine and medium roots; few very fine discontinuous pores; slightly acid; clear wavy boundary.

C1-24 to 30 inches; light yellowish brown (10YR 6/4) loamy coarse sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; few fine and medium roots; few very fine discontinuous pores; moderately acid; clear wavy boundary.

C2-30 to 60 inches; light yellowish brown (10YR 6/4) sand, dark yellowish brown (10YR 4/4) moist; single grain; loose; moderately acid.

The content of organic carbon is less than 0.6 percent. The control section has 0 to 10 percent rock fragments. Reaction is neutral to moderately acid throughout the profile.

The A horizon has value of 3 to 5 when dry and 2 or 3 when moist and chroma of 2 or 3 when dry and moist.

The Bw and BC horizons have value of 4 to 6 when dry and 3 or 4 when moist and chroma of 3 or 4 when dry and moist. The texture is loamy sand or loamy fine sand.

The C horizon has hue of 10YR or 2.5Y, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. The texture is loamy sand, loamy coarse sand, or sand.

Sacheen Variant

The Sacheen Variant consists of very deep, somewhat poorly drained soils in lake basins and on flood plains along streams. These soils formed in sandy alluvium of mixed mineralogy. The alluvium has an admixture of volcanic ash and loess in the upper part. Slope is 0 to 3 percent. Elevation is 2,000 to 2,400 feet. The average annual precipitation is about 25 to 27 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are mixed, frigid Aquic Xeropsamments.

Typical pedon of Sacheen Variant silt loam, about 3.1 miles south and 4.75 miles west of Usk, 300 feet south and 200 feet east of the northwest corner of sec. 21, T. 32 N., R. 43 E.

A-0 to 4 inches; light brownish gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure; slightly hard, very friable, slightly sticky and nonplastic; many very fine and fine and few medium roots; slightly acid; abrupt smooth boundary.

Bw-4 to 6 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; common fine distinct mottles, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; slightly acid; clear wavy boundary.

2C1-6 to 10 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; common fine and medium distinct mottles, dark brown (7.5YR 4/4) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; common very fine, fine, and medium roots; about 5 percent pebbles; slightly acid; clear wavy boundary.

2C2-10 to 36 inches; pale brown (10YR 6/3) coarse sand, brown (10YR 5/3) moist; common fine and medium distinct mottles, dark brown (7.5YR 4/4) moist; single grain; loose; few very fine, fine, and medium roots; about 10 percent pebbles; neutral; clear wavy boundary.

2C3-36 to 60 inches; light brownish gray (2.5Y 6/2) coarse sand, grayish brown (2.5Y 5/2) moist; common fine and medium distinct mottles, dark brown (7.5YR 4/4) moist; single grain; loose; few very fine, fine, and medium roots; about 10 percent pebbles; neutral.

Reaction is slightly acid or neutral throughout the profile.

The A horizon has value of 4 to 6 when dry and 2 or 3 when moist and chroma of 1 or 2 when dry and moist.

The Bw horizon has value of 4 to 6 when dry and 3 or 4 when moist and chroma of 3 or 4 when dry and moist. The texture is silt loam or sandy loam.

The C horizon has hue of 2.5Y or 10YR, value of 4 to 6 when dry and 4 or 5 when moist, and chroma of 2 or 3 when dry and moist. It is coarse sand or loamy coarse sand below a depth of 10 inches and has 0 to 15 percent pebbles.

Scotia Series

The Scotia series consists of very deep, well drained soils on terraces. These soils formed in glaciofluvial material of mixed mineralogy. This material has an admixture of volcanic ash and loess in the upper part. Slope is 0 to 25 percent. Elevation is 2,000 to 3,400 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are coarse-loamy, mixed, frigid Vitrandic Haploxeralfs.

Typical pedon of Scotia fine sandy loam, 7 to 15 percent slopes, about 0.5 mile south and 2.1 miles east of the southeast end of Sacheen Lake, 150 feet north and 200 feet east of the southwest corner of sec. 33, T. 31 N., R. 44 E.

Oe-1 inch to 0; partially decomposed organic litter of needles, leaves, and twigs; abrupt smooth boundary.

Bw1-0 to 7 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine, medium, and coarse roots; few fine discontinuous pores; slightly acid; clear wavy boundary.

Bw2-7 to 12 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine, medium, and coarse roots; few fine discontinuous pores; slightly acid; clear wavy boundary.

E-12 to 20 inches; very pale brown (10YR 7/3) loamy fine sand, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine and few medium and coarse roots; few very fine and fine discontinuous pores; slightly acid; clear wavy boundary.

E&Btl-20 to 31 inches; about 60 percent very pale brown (10YR 7/4) loamy fine sand (E part), yellowish brown (10YR 5/4) moist; common fine distinct mottles, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; few medium and coarse roots; few very fine and fine discontinuous pores; about 40 percent lamellae of brown (7.5YR 5/4) sandy loam (Bt part), dark brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few medium and coarse roots; clay films in pores and clay bridges between sand grains; moderately acid; clear wavy boundary.

E&Bt2-31 to 60 inches; about 75 percent very pale brown (10YR 7/4) loamy sand (E part), yellowish brown (10YR 5/4) moist; common fine distinct mottles, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; few medium and coarse roots; few very fine and fine discontinuous pores; about 25 percent lamellae of brown (7.5YR 5/4) sandy loam (Bt part), dark brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; clay films in pores and clay bridges between sand grains; slightly acid.

Reaction is moderately acid to neutral throughout the profile. The control section has 0 to 10 percent rock fragments.

The Bw horizon has hue of 10YR or 7.5YR, value of 4 to 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. The texture is fine sandy loam or loam.

The E part of the E&Bt horizon has hue of 2.5Y or 10YR, value of 5 to 7 when dry and 3 to 5 when moist, and chroma of 3 or 4 when dry and moist. The texture is loamy fine sand or loamy sand.

The Bt part of the E&Bt horizon has hue of 10YR or 7.5YR, value of 5 to 7 when dry and 4 or 5 when moist, and chroma of 3 or 4 when dry and moist. It consists of lamellae 1/2 inch to 3 inches thick. The total thickness of the lamellae is 6 to 12 inches. The texture is loamy sand or sandy loam. The content of clay is 5 to 15 percent.

Scrabblers Series

The Scrabblers series consists of very deep, well drained soils on terraces. These soils formed in a mantle of volcanic ash and loess over sandy glacial outwash derived dominantly from granitic rock. Slope is 0 to 20 percent. Elevation is 2,200 to 4,500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 43 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are sandy, mixed, frigid Andic Xerochrepts.

Typical pedon of Scrabblers silt loam, 0 to 20 percent slopes, about 3.75 miles south and 6.25 miles west of Blueslide, 500 feet north and 1,000 feet west of the southeast corner of sec. 27, T. 35 N., R. 42 E.

Oe-1 inch to 0; partially decomposed organic litter of twigs, bark, needles, and leaves; abrupt smooth boundary.

A-0 to 3 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 3/4) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; common fine and medium roots; common fine pores; about 5 percent pebbles; neutral; clear wavy boundary.

Bw-3 to 9 inches; light brown (7.5YR 6/4) silt loam, dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine and common medium roots; many fine pores; about 10 percent

pebbles; neutral; abrupt smooth boundary.

BC-9 to 13 inches; light yellowish brown (10YR 6/4) sandy loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine roots; few fine irregular pores; about 10 percent pebbles; slightly acid; clear wavy boundary.

2C1-13 to 18 inches; very pale brown (10YR 7/4) gravelly loamy sand, yellowish brown (10YR 5/4) moist; single grain; loose; common fine roots; few fine pores; about 15 percent pebbles; slightly acid; clear wavy boundary.

2C2-18 to 28 inches; very pale brown (10YR 7/3) gravelly loamy sand, brown (10YR 5/3) moist; single grain; loose; few fine roots; few fine pores; about 20 percent pebbles; slightly acid; clear wavy boundary.

2C3-28 to 60 inches; very pale brown (10YR 713) gravelly loamy sand, brown (10YR 5/3) moist; single grain; loose; few fine roots; about 25 percent pebbles; slightly acid.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. Reaction is slightly acid or neutral throughout the profile. A thin layer of light colored volcanic ash is at the surface in some pedons.

The A horizon has value of 4 or 5 when dry and 2 or 3 when moist and chroma of 3 or 4 when dry and moist.

The Bw horizon has hue of 10YR or 7.5YR, value of 5 to 7 when dry and 3 to 5 when moist, and chroma of 3 or 4 when dry and moist. The texture is silt loam, loam, or very fine sandy loam. The content of pebbles is as much as 10 percent.

The BC horizon has hue of 10YR or 2.5Y, value of 6 to 8 when dry and 5 or 6 when moist, and chroma of 3 or 4 when dry and moist. The texture is sandy loam, loamy sand, or fine sandy loam. The content of pebbles is 5 to 10 percent. Some pedons have a 2BC horizon.

The 2C horizon has hue of 10YR or 2.5Y, value of 7 or 8 when dry and 5 or 6 when moist, and chroma of 3 or 4 when dry and moist. The texture is gravelly loamy sand or loamy sand. The content of pebbles is 0 to 25 percent.

Sherlock Series

The Sherlock series consists of very deep, well drained soils on foothills and mountains. These soils formed in a mantle of volcanic ash and loess over glacial till of mixed mineralogy. Slope is 0 to 65 percent. Elevation is 3,900 to 5,200 feet. The average annual precipitation is 40 to 50 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 60 to 90 days.

These soils are loamy-skeletal, mixed Andic Cryoboralfs.

Typical pedon of Sherlock silt loam, 0 to 30 percent slopes, about 1.75 miles south and 7.25 miles west of Boundary Dam, 500 feet north and 1,650 feet east of the southwest corner of sec. 13, T. 40 N., R. 44 E.

Oe-1 inch to 0; partially decomposed needles, leaves, twigs, bark, moss, and lichens; abrupt smooth boundary.

E-0 to '/2 inch; gray (10YR 6/1) very fine sandy loam (volcanic ash), dark gray (10YR 4/1) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and medium roots; about 5 percent pebbles; moderately acid; abrupt broken boundary.

Bw1-1/2 inch to 4 inches; yellowish brown (10YR 5/6) silt loam, dark brown (7.5YR 3/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine and fine and few medium and coarse roots; about 10 percent pebbles; moderately acid; clear wavy boundary.

Bw2-4 to 9 inches; yellow (10YR 7/6) silt loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; soft, *very* friable, nonsticky and nonplastic; moderately smeary; common very fine and fine and few medium and coarse roots; about 10 percent pebbles; slightly acid; abrupt wavy boundary.

2Bt1-9 to 28 inches; light gray (2.5Y 7/2) very gravelly silt loam, olive brown (2.5Y 4/4) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky and plastic; few very fine, fine, and coarse roots; few moderately thick clay films on faces of peds and lining pores; about 30 percent pebbles and 10 percent cobbles; neutral; clear wavy boundary.

2Bt2-28 to 60 inches; pale olive (5Y 6/3) very gravelly silty clay loam, olive (5Y 4/3) moist; moderate medium subangular blocky structure; very hard, very firm, very sticky and plastic; few *very* fine and fine roots; continuous thick clay films on faces of peds and lining pores; about 35 percent pebbles and 15 percent cobbles; neutral.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. The thickness of the solum ranges from 50 to more than 60 inches. The argillic horizon has 25 to 35 percent clay. The control section has 35 to 60 percent rock fragments. Reaction is moderately acid to neutral throughout the profile. Some pedons have an A horizon.

The E horizon, if it occurs, has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 1 or 2 when dry and moist. It has 0 to 10 percent rock fragments.

The Bw horizon has hue of 5YR, 7.5YR, or 10YR, value of 5 to 7 when dry and 3 or 4 when moist, and chroma of 4 to 6 when dry and moist. The texture is gravelly loam, loam, or silt loam. The content of pebbles is 0 to 20 percent.

The 2Bt horizon has hue of 2.5Y or 5Y, value of 5 to 7 when dry and 3 or 4 when moist, and chroma of 2 to 4 when dry and moist. The texture is very gravelly silt loam, very gravelly clay loam, or very gravelly silty clay loam.

Skanid Series

The Skanid series consists of shallow, well drained soils on south- and west-facing slopes on foothills and mountains. These soils formed in residuum and colluvium derived dominantly from granitic rock. The residuum and colluvium have an admixture of loess and volcanic ash. Slope is 0 to 65 percent. Elevation is 2,000 to 3,000 feet. The average annual precipitation is 22 to 27 inches, the average annual air temperature is about 47 degrees F, and the average growing season (at 28 degrees) is 110 to 130 days.

These soils are loamy-skeletal, mixed, mesic, shallow Entic Ultic Haploxerolls.

Typical pedon of Skanid loam, in an area of Skanid-Rock outcrop complex, 0 to 40 percent slopes, about 1.5 miles south and 0.5 mile west of Kent Meadow Lake, 800 feet north and 800 feet west of the southeast corner of sec. 21, T. 31 N., R. 44 E.

A1-0 to 2 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and nonplastic; common fine roots; common fine pores; about 12 percent pebbles; neutral; clear wavy boundary.

A2-2 to 7 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common fine roots; common fine pores; about 20 percent pebbles; neutral; clear wavy boundary.

C1-7 to 13 inches; pale brown (10YR 6/3) very gravelly sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and nonplastic; few fine roots; few fine and very fine pores; about 45 percent pebbles; neutral; clear wavy boundary.

C2-13 to 16 inches; pale brown (10YR 6/3) very gravelly coarse sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and nonplastic; few fine and very fine roots; few fine and very fine pores; about 55 percent pebbles; slightly acid; abrupt wavy boundary.

Cr-16 inches; weathered granite.

The depth to weathered bedrock ranges from 10 to 20 inches. The control section has more than 35 percent pebbles. Reaction is slightly acid or neutral throughout the profile.

The A horizon has value of 4 or 5 when dry and 2 or 3 when moist and chroma of 2 or 3 when dry and moist. It has 10 to 30 percent pebbles.

The C horizon has value of 5 or 6 when dry and 3 to 5 when moist and chroma of 2 or 3 when dry and moist. The texture is very gravelly loam, very gravelly sandy loam, or very gravelly coarse sandy loam.

Smackout Series

The Smackout series consists of very deep, well drained soils on foothills and mountains. These soils formed in a mantle of volcanic ash and loess over fine textured glacial till derived dominantly from shaly rock. Slope is 0 to 65 percent. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 25 to 32 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are fine-loamy, mixed, frigid Andic Xerochrepts.

Typical pedon of Smackout loam, 20 to 40 percent slopes, about 5.5 miles north and 5.25 miles west of lone, 1,500 feet north and 2,000 feet west of the southeast corner of sec. 6, T. 38 N., R. 42 E.

Oe-1 1/2 inches to 0; partially decomposed needles, leaves, twigs, bark, and cones; abrupt smooth boundary.

Bw1-0 to 5 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 3/4) moist; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many fine and medium and few coarse roots; many fine pores; about 5 percent pebbles; neutral; clear wavy boundary.

Bw2-5 to 12 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many fine and medium and few coarse roots; many fine pores; about 8 percent pebbles; neutral; clear wavy boundary.

2BC1-12 to 17 inches; light brownish gray (2.5Y 6/2) gravelly loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine pores; about 15 percent pebbles; neutral; clear wavy boundary.

2BC2-17 to 24 inches; light brownish gray (2.5Y 6/2) gravelly silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common fine and medium and few coarse roots; common fine pores; about 18 percent pebbles; neutral; clear wavy boundary.

2BC3-24 to 30 inches; light brownish gray (2.5Y 6/2) gravelly silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common fine and medium and few coarse roots; common fine pores; about 25 percent pebbles; neutral; clear wavy boundary.

2BC4-30 to 45 inches; light brownish gray (2.5Y 6/2) gravelly sandy clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; slightly hard, firm, sticky and plastic; few fine, medium, and coarse roots; few fine pores; about 30 percent pebbles; mildly alkaline; clear wavy boundary.

2C-45 to 60 inches; light brownish gray (2.5Y 6/2) gravelly loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, firm, slightly sticky and slightly plastic; few fine, medium, and coarse roots; few fine pores; mildly alkaline.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. The control section has 20 to 30 percent clay. Reaction is neutral or mildly alkaline throughout the profile. A thin layer of light colored volcanic ash is at the surface in some pedons.

The Bw horizon has hue of 10YR or 7.5YR, value of 5 to 7 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. It has 1 to 10 percent pebbles.

The 2BC and 2C horizons have hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 when dry and 3 or 4 when moist, and chroma of 1 or 2 when dry and moist. The texture is gravelly loam, gravelly sandy clay loam, or gravelly silty clay loam.

Smackout Variant

The Smackout Variant consists of very deep, well drained soils on mountains. These soils formed in a mantle of volcanic ash and loess over fine textured glacial till derived dominantly from shaly rock. Slope is 20 to 65 percent. Elevation is 3.500 to 6,000 feet. The average annual precipitation is 35 to 45 inches, the average annual air temperature is about 39 degrees F, and the average growing season (at 28 degrees) is 60 to 80 days.

These soils are fine-loamy, mixed Andic Cryochrepts.

Typical pedon of Smackout Variant silt loam, 40 to 65 percent slopes, about 1.25 miles south and 0.25 mile west of Monumental Mountain, 1,200 feet north and 500 feet east of the southwest corner of sec. 36, T. 37 N., R. 44 E.

Oe-1 1/2 inches to 0; loose, partially decomposed organic litter of bark, twigs, leaves, needles, moss, and cones; abrupt smooth boundary.

Bw1-0 to 7 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5Y 3/4) moist; weak medium and coarse subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many fine and medium and few coarse roots; many fine pores; about 5 percent pebbles; slightly acid; clear wavy boundary.

Bw2-7 to 10 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 3/4) moist; moderate coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; weakly smeary; many fine and medium and few coarse roots; common fine pores; about 10 percent pebbles; slightly acid; clear wavy boundary.

2BC-10 to 16 inches; pale brown (10YR 6/3) gravelly loam, brown (10YR 5/3) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common fine pores; about 20 percent pebbles; slightly acid; clear wavy boundary.

2C1-16 to 38 inches; light brownish gray (2.5Y 6/2) gravelly silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; few fine roots; few fine pores; about 25 percent pebbles; moderately acid; clear wavy boundary.

2C2-38 to 60 inches; light brownish gray (2.5Y 6/2) gravelly sandy clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; few fine roots; few fine pores; about 30 percent pebbles; moderately acid.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. The control section has 20 to 30 percent clay. Reaction is slightly acid or moderately acid throughout the profile. A thin layer of light colored volcanic ash is at the surface in some pedons.

The Bw horizon has hue of 10YR or 7.5YR, value of 5 to 7 when dry and 3 or 4 when moist, and chroma of

3 or 4 when dry and moist. It has 5 to 15 percent rock fragments.

The 2BC and 2C horizons have hue of 10YR or 2.5Y, value of 5 to 7 when dry and 3 to 5 when moist, and chroma of 1 to 3 when dry and moist. The texture is gravelly sandy clay loam, gravelly silty clay loam, or gravelly loam.

Threemile Series

The Threemile series consists of deep, well drained soils on foothills and mountains. These soils formed in a mantle of volcanic ash and loess over calcareous glacial till. Slope is 0 to 65 percent. Elevation is 2,400 to 4,000 feet. The average annual precipitation is 25 to 37 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are loamy-skeletal, mixed, frigid Andic Xerochrepts.

Typical pedon of Threemile silt loam, 25 to 40 percent slopes, about 1.75 miles south and 5.25 miles east of Boundary Dam, 1,400 feet north and 660 feet east of the southwest corner of sec. 15, T. 40 N., R. 44 E.

Oe-1 1/2 inches to 0; partially decomposed organic litter of leaves, needles, bark, twigs, and cones; abrupt smooth boundary.

Bw1-0 to 4 inches; yellowish brown (10YR 5/4) silt loam, dark brown (7.5YR 414) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine and common medium roots; many very fine vesicular pores; about 5 percent pebbles; neutral; clear wavy boundary.

Bw2-4 to 10 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; many very fine and fine and common medium roots; very fine vesicular pores; about 10 percent pebbles; neutral; clear wavy boundary.

2BC-10 to 15 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 413) moist; moderate fine subangular blocky structure; slightly hard, very friable, sticky and plastic; common very fine, fine, and medium roots; common very fine irregular pores; about 20 percent pebbles; neutral; gradual wavy boundary.

2C1-15 to 32 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist; massive; hard, firm, sticky and plastic; few very fine, fine, and medium roots; few very fine irregular pores; about 45 percent pebbles and 10 percent cobbles; strongly effervescent; mildly alkaline; clear wavy boundary.

2C2-32 to 52 inches; light brownish gray (2.5Y 6/2) extremely gravelly loam, grayish brown (2.5Y 5/2) moist; massive; hard, firm, slightly sticky and plastic; few fine, medium, and coarse roots; few very fine irregular pores; about 50 percent pebbles, 10 percent cobbles, and 5 percent stones; violently effervescent; mildly alkaline; clear wavy boundary.

2R-52 inches; limestone.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness. The depth to bedrock ranges from 40 to 60 inches. The control section has 35 to 85 percent rock fragments. Free carbonates are in and below the control section. A thin layer of light colored volcanic ash is at the surface in some pedons.

The Bw horizon has hue of 10YR or 7.5YR, value of 5 or 6 when dry and 3 to 5 when moist, and chroma of 2 to 4 when dry and moist. It has 0 to 10 percent pebbles.

The 2BC horizon has value of 5 or 6 when dry and 4 or 5 when moist and chroma of 2 to 4 when dry and moist. The texture is gravelly silt loam or gravelly loam. Reaction is neutral or mildly alkaline.

The 2C horizon has hue of 2.5Y or 10YR, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 2 to 4 when dry and moist. The texture is very gravelly loam, very gravelly sandy loam, extremely gravelly coarse sandy loam, or extremely gravelly loam. Reaction is mildly alkaline or moderately alkaline.

Uncas Series

The Uncas series consists of very deep, very poorly drained soils on flood plains and in old lake basins. These soils formed in muck and alluvium derived dominantly from volcanic ash. They are frequently flooded. Slope is 0 to 3 percent. Elevation is 1,900 to 3,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period (at 32 degrees) is 90 to 120 days.

These soils are ashy, frigid Histic Vitraquands.

Typical pedon of Uncas muck, about 2.1 miles south and 3.75 miles east of Scotia, 300 feet south and 1,200 feet west of the northeast corner of sec. 26, T. 30 N., R. 45 E.

Op-0 to 7 inches; dark gray (10YR 4/1) muck, black (10YR 2/1) moist; about 15 percent fibers, less than

5 percent rubbed; moderate fine and medium granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; neutral; clear wavy boundary.

A-7 to 14 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; few fine distinct mottles, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; neutral; clear wavy boundary.

Bg-14 to 21 inches; white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) moist; few fine and medium distinct mottles, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; neutral; clear wavy boundary.

Cg1-21 to 32 inches; white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) moist; common fine and medium distinct mottles, dark brown (10YR 3/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; neutral; clear wavy boundary.

Cg2-32 to 37 inches; pale yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist; common fine and medium distinct mottles, dark brown (10YR 3/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; neutral; clear wavy boundary.

Cg3-37 to 43 inches; olive gray (5Y 5/2) silt loam, dark olive gray (5Y 3/2) moist; common fine and medium distinct mottles, light gray (5Y 7/1) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; neutral; clear wavy boundary.

Cg4-43 to 60 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; many fine and medium distinct mottles, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; neutral.

These soils are saturated in winter and spring. The Op horizon has 20 to 30 percent organic carbon. The A horizon has value of 4 to 6 when dry and 2 to 4 when moist and chroma of 1 or 2 when dry and moist.

The Bg and Cg horizons have hue of 2.5Y or 5Y, value of 5 to 8 when dry and 3 to 6 when moist, and chroma of 1 to 4 when dry and moist. They have few to many mottles, which are fine or medium. Reaction is neutral or mildly alkaline.

Uncas Variant

The Uncas Variant consists of very deep, very poorly drained soils on flood plains and in old lake basins. These soils formed in alluvium derived dominantly from volcanic ash. Slope is 0 to 3 percent. Elevation is 3,000 to 5,000 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is about 41 degrees F, and the average growing season (at 28 degrees) is 70 to 90 days.

These soils are ashy Histic Cryaquands.

Typical pedon of Uncas Variant muck, about 0.5 mile south of Bunchgrass Lake, 2,400 feet south and 700 feet west of the northeast corner of sec. 24, T. 37 N., R. 44 E.

Op-0 to 6 inches; dark gray (10YR 4/1) muck, black (10YR 2.5/1) moist; about 12 percent fibers, less than 3 percent rubbed; moderate medium and coarse granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine pores; slightly acid; abrupt smooth boundary.

A-6 to 14 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; common fine and medium distinct mottles, yellowish brown (10YR 5/6) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine pores; slightly acid; clear wavy boundary.

C-14 to 20 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; many fine and medium distinct mottles, yellowish brown (10YR 5/6) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine pores; slightly acid; clear wavy boundary.

Cg1-20 to 30 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; many fine and medium distinct mottles, yellowish brown (10YR 5/6) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine pores; slightly acid; clear wavy boundary.

Cg2-30 to 51 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5.2) moist; many fine and medium distinct mottles, dark brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine pores; slightly acid; clear wavy boundary.

2Cg3-51 to 60 inches; light gray (10YR 7/1) sandy loam, gray (10YR 5/1) moist; many fine and medium distinct mottles, dark brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine and fine pores; slightly acid.

These soils are saturated in winter and spring. The Op horizon is 20 to 30 percent organic carbon. Reaction is slightly acid or neutral throughout the profile. Depth to the 2Cg horizon is 40 to more than 60 inches.

The A horizon has value of 4 to 6 when dry and 3 or 4 when moist and chroma of 1 or 2 when dry and moist.

The C horizon has value of 6 to 8 when dry and 4 to 6 when moist and chroma of 2 or 3 when dry and moist. The texture is silt loam or loam.

The Cg horizon has hue of 10YR or 2.5Y, value of 6 to 8 when dry and 4 to 6 when moist, and chroma of 1 or 2 when dry and moist. The texture is silt loam, loam, or sandy loam. The 2Cg horizon varies widely in color and texture.

Usk Series

The Usk series consists of moderately deep, well drained soils on south- and west-facing slopes on foothills and mountains. These soils formed in residuum and colluvium derived dominantly from granitic rock. The residuum and colluvium have an admixture of volcanic ash and loess. Slope is 0 to 65 percent. Elevation is 1,800 to 3,000 feet. The average annual precipitation is 24 to 30 inches, the average annual air temperature is about 46 degrees F, the average growing season (at 28 degrees) is 110 to 130 days, and the average frost-free period (at 32 degrees) is 85 to 115 days.

These soils are coarse-loamy, mixed, mesic Vitrandic Haploxerolls.

Typical pedon of Usk loam, 40 to 65 percent slopes, about 3 miles south and 3.5 miles east of Scotia, 3,000 feet east of the southwest corner of sec. 26, T. 30 N., R. 44 E.

Oe-1 inch to 0; partially decomposed organic litter of pine needles, leaves, twigs, and cones; abrupt smooth boundary.

A-0 to 9 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; many fine and few medium and coarse roots; many very fine irregular pores; about 10 percent pebbles; slightly acid; clear wavy boundary.

Bw-9 to 19 inches; pale brown (10YR 6/3) gravelly loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and few medium and coarse roots; many very fine irregular pores; about 20 percent pebbles; slightly acid; clear wavy boundary.

BC-19 to 26 inches; light yellowish brown (10YR 6/4) gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common fine and few medium and coarse roots; many fine irregular pores; about 30 percent pebbles; slightly acid; clear wavy boundary.

C-26 to 32 inches; light yellowish brown (10YR 6/4) gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky and nonplastic; few fine, medium, and coarse roots; many fine irregular pores; about 30 percent pebbles; slightly acid; abrupt wavy boundary.

Cr-32 inches; light gray (10YR 7/2), weathered granite that crushes to very gravelly loamy coarse sand, very pale brown (10YR 5/3) moist.

The depth to weathered bedrock ranges from 20 to 40 inches. The control section has 15 to 35 percent rock fragments. Reaction is neutral or slightly acid throughout the profile. Some pedons have a stony surface layer.

The A horizon has value of 4 or 5 when dry and 2 or 3 when moist and chroma of 2 or 3 when dry and moist. It has 5 to 15 percent rock fragments.

The Bw horizon has value of 5 or 6 when dry and 3 or 4 when moist and chroma of 3 or 4 when dry and moist. The texture is gravelly loam or gravelly sandy loam.

The BC and C horizons have value of 5 to 7 when dry and 4 or 5 when moist and chroma of 2 to 4 when dry and moist. The texture is gravelly sandy loam or gravelly loamy coarse sand. Some pedons have bands of dark brown (10YR 3/3) sandy loam in the lower part. The bands range from 0.5 millimeter to 15 millimeters in thickness.

Vassar Series

The Vassar series consists of deep, well drained soils on mountains. These soils formed in a thick mantle of volcanic ash and loess over residuum and colluvium derived dominantly from granitic or metasedimentary rock. Slope is 30 to 65 percent. Elevation is 3,000 to 6,000 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is about 40 degrees F, and the average growing season (at 28 degrees) is 70 to 90 days.

These soils are ashy over loamy, mixed Typic Vitricryands.

Typical pedon of Vassar silt loam, 30 to 65 percent slopes, about 6.75 miles west of the south end of Davis Lake, 1,000 feet south and 1,200 feet west of the northeast corner of sec. 1, T. 31 N., R. 42 E.

Oe-1 1/2 inches to 0; partially decomposed organic litter of needles, leaves, twigs, and cones; abrupt smooth boundary.
A-0 to 16 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; common very fine, fine, and medium roots; common fine pores; neutral; gradual smooth boundary.
Bw-16 to 24 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; common very fine, fine, and medium roots; common fine pores; neutral; clear smooth boundary.
2C1-24 to 31 inches; very pale brown (10YR 7/3) coarse sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and nonplastic; common fine and medium and few coarse roots; many fine pores; about 5 percent pebbles; slightly acid; clear wavy boundary.
2C2-31 to 43 inches; very pale brown (10YR 7/3) coarse sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable, slightly sticky and nonplastic; common fine and medium and few coarse roots; many fine pores; about 5 percent pebbles; slightly acid; clear wavy boundary.
2C3-43 to 52 inches; light gray (2.5Y 7/2) loamy coarse sand, light brownish gray (2.5Y 6/2) moist; massive; slightly hard, friable, slightly sticky and nonplastic; few fine and coarse and common medium roots; common fine pores; about 10 percent pebbles; slightly acid; clear wavy boundary.
2Cr-52 inches; fractured granite.

The depth to weathered bedrock ranges from 40 to 60 inches. The mantle of volcanic ash and loess ranges from 14 to 30 inches in thickness. The upper part of the control section has more than 60 percent volcanic ash. A thin layer of light colored volcanic ash is at the surface in some pedons.

The A horizon has value of 4 or 5 when dry and chroma of 2 or 3 when dry and moist. Reaction is moderately acid to neutral.

The Bw horizon has hue of 10YR or 7.5YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. The texture is loam or silt loam. The content of rock fragments is as much as 15 percent. Reaction is moderately acid to neutral.

The 2C horizon has hue of 10YR or 2.5Y, value of 5 to 7 when dry and 4 to 6 when moist, and chroma of 2 or 3 when dry and moist. The fine-earth texture is sandy loam, coarse sandy loam, or loamy coarse sand. The content of rock fragments is 5 to 35 percent. Reaction is strongly acid to neutral.

Waits Series

The Waits series consists of very deep, well drained soils on foothills and mountains. These soils formed in a mantle of volcanic ash and loess over calcareous glacial till. Slope is 0 to 65 percent. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 44 degrees F, the average growing season (at 28 degrees) is 90 to 110 days, and the average frost-free period (at 32 degrees) is 75 to 105 days.

These soils are coarse-loamy, mixed, frigid Andic Xerochrepts.

Typical pedon of Waits loam, 15 to 25 percent slopes, about 4.25 miles north of Metaline Falls, 400 feet north and 1,900 feet west of the southeast corner of sec. 33, T. 40 N., R. 43 E.

Oe-1 1/2 inches to 0; partially decomposed organic litter of leaves, bark, twigs, and needles; abrupt smooth boundary.
E-0 to 1/2 inch; light gray (10YR 7/2) very fine sandy loam (volcanic ash), grayish brown (10YR 5/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic:, neutral; abrupt smooth boundary.
Bw1-1/2 inch to 7 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium granular structure parting to weak fine and medium subangular blocky; soft, very friable, slightly sticky and slightly plastic; weakly smeary; common fine and medium and few coarse roots; common fine irregular pores; about 10 percent pebbles; neutral; clear wavy boundary.
Bw2-7 to 13 inches; light yellowish brown (10YR 6/4) silt loam, dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; weakly smeary; common fine and medium roots; common fine tubular pores; about 12 percent pebbles; mildly alkaline; abrupt smooth boundary.
2BC-13 to 24 inches; light yellowish brown (10YR 6/4) gravelly loam, dark yellowish brown (10YR 4/4)

moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; about 20 percent pebbles; mildly alkaline; abrupt smooth boundary.

2C1-24 to 35 inches; light gray (10YR 7/2) gravelly loam, grayish brown (10YR 5/2) moist; massive; hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common fine pores; about 30 percent pebbles; moderately effervescent; moderately alkaline; clear wavy boundary.

2C2-35 to 60 inches; light gray (10YR 7/2) gravelly loam, grayish brown (10YR 5/2) moist; massive; hard, firm, slightly sticky and slightly plastic; few medium roots; few fine pores; about 30 percent pebbles and 5 percent cobbles; moderately effervescent; moderately alkaline.

The mantle of volcanic ash and loess ranges from 7 to 14 inches in thickness.

The E horizon, if it occurs, has value of 6 or 7 when dry and 4 or 5 when moist and chroma of 1 or 2 when dry and moist.

The Bw horizon has hue of 10YR or 7.5YR, value of 5 to 7 when dry and 3 or 4 when moist, and chroma of 3 or 4 when dry and moist. The texture is very fine sandy loam, loam, or silt loam. The content of pebbles is 5 to 15 percent. Reaction is neutral or mildly alkaline.

The 2BC and 2C horizons have value of 6 or 7 when dry and 4 or 5 when moist. The 2BC horizon has chroma of 3 or 4 when dry and moist, and the 2C horizon has chroma of 2 or 3 when dry and moist. These horizons are gravelly loam or gravelly sandy loam. They are mildly alkaline or moderately alkaline.

Formation of the Soils

Soil is a natural, three-dimensional body on the surface of the Earth. Typically, it contains mineral and organic material, air, and water. It supports or is capable of supporting plants and is commonly modified by human activity. The upper limit of soil is the air or atmosphere. The lower limit is the underlying material, or regolith, which is virtually unaffected by biological activity; bedrock; or other consolidated earthy material.

Soil forms through the physical and chemical weathering of deposited or accumulated geologic parent material. The characteristics and properties of a soil at any given place are determined by the interaction of the following five factors: the physical and mineralogical composition of the parent material; the plant and animal life in and on the soil; the climate under which the soil material accumulated and has existed since accumulation; the topography, or the lay of the land; and the age of the soil, or the length of time that the forces of soil formation have acted on the parent material.

The five factors are interdependent. Each tends to modify the other four. Climate and living organisms, particularly vegetation, are the active forces of soil formation. Their effect on parent material is modified by topography and by the length of time that the parent material has been in place. The relative importance of each factor differs from place to place. In some areas one factor dominates and determines most of the properties of the soil. Normally, however, the interaction of all five factors determines the kind of soil that forms in any given place.

Parent Material

Parent material is that part of the regolith at the Earth's surface in which soil forms. The soils in the survey area formed in glacial drift, including till, outwash, and lacustrine sediments; residuum and colluvium derived from igneous, metamorphic, and sedimentary rocks; volcanic ash and loess; and recent accumulations of alluvium and organic material.

During the Pleistocene Epoch, large sections of the survey area were covered by the Colville Lobe of the Cordilleran Ice Sheet. The center of the ice cap was in British Columbia (11). Direct evidence indicates that the ice reached elevations of more than 5,000 feet in the northern part of the survey area and about 3,000 feet in the southern part. Residual soil material is in areas that were not covered by ice or inundated by floods caused by meltwater. These areas are throughout the survey area, generally at elevations above those of the ice sheet or south of the ice front.

When the ice sheet moved southward, it mixed existing residual soils with material that was being carried by the ice. This mixture, which was deposited directly by the ice, is known as glacial till. It was exposed when the ice sheet melted. In many places in the survey area, meltwater had little effect on the glacial till. The till is dominantly an unstratified, heterogeneous mixture of clay, silt, sand, and gravel, but in places it has stones and boulders. It was derived from nearby granite, quartzite, andesite, argillite, phyllite, gneiss, schist, dolomite, and limestone.

Recent deposits of loess and volcanic ash have accumulated in most of the glaciated and unglaciated areas. Volcanic ash from at least two major postglacial eruptions in the Cascade Mountains was deposited in most of the survey area. The main sources of ash were the eruptions of Glacier Peak in the North Cascades about 12,000 years ago and the eruption of Mount Mazama in the southern Oregon Cascades about 6,600 years ago (4). Thin layers of ash from the eruption of Mount St. Helens are near the surface of some soils. Volcanic ash is an important constituent of the upper horizons of most of the soils in the survey area. Soils formed in volcanic ash have a low bulk density and a relatively high available water capacity (14). Rathdrum soils are an example of soils that formed in thick deposits of volcanic ash. Typically, they are more than 60 inches deep. Newbell and Inkler are examples of soils that formed in glacial till having a thin mantle of volcanic ash.

Streams of meltwater issuing from ice fronts transported, sorted, and deposited glacial material.

These deposits are called glacial outwash and occur as terraces in primary and secondary drainage channels. Outwash terraces commonly are nearly level, but some are strongly sloping. Terrace escarpments are steep or very steep. The glacial outwash has a high content of sand or sand and gravel and a low content of clay and silt. Bonner and Kiehl are examples of soils that formed in glacial outwash having a high content of sand and gravel and a mantle of volcanic ash and loess. Scrabblers soils are an example of soils that formed in glacial outwash having a high content of sand and a mantle of volcanic ash.

Glacial lakes formed where drainageways were temporarily blocked or damned by glaciers and glacial debris. Very fine sand, silt, and clay were deposited in these lakes. Remnants of old lake terraces are along the Pend Oreille River. In places glacial lake sediments are mantled by an admixture of volcanic ash and loess. Anglen and Cusick are examples of soils that formed in glacial lake sediments. Anglen soils are fine, mixed, frigid Andic Palexeralfs. Cusick soils are fine, mixed, frigid Aquic Haploxeralfs.

The higher mountains in the survey area were not glaciated. The most common kinds of parent material in these areas are colluvium derived from bedrock, either an admixture or mantle of volcanic ash and loess, and material weathered from bedrock, generally granitic or shaly rock. Mobate soils are an example of soils that formed in material weathered from granitic rock and in volcanic ash. Raisio soils formed in material weathered from shaly rock and an admixture of volcanic ash and loess.

Recent alluvium is the primary parent material along streams and in small basins. It eroded from uplands and was deposited during periods of stream overflow. The soils that formed in this material are stratified. They range from very poorly drained to moderately well drained. Blueslide and Kegel are examples.

Organic soils are of minor extent in the survey area. They formed in wet depressions and in areas adjacent to lakes where hydrophytic plants grew and the resulting organic residue was preserved. Pywell soils formed in organic material. Some organic soils have thin layers of volcanic ash, diatomaceous earth, or alluvium.

Climate

Differences in climate result in differences in soil properties. The amount, kind, and seasonal distribution of precipitation and the length of the growing season largely determine the types of vegetation on a soil, the volume of organic matter returned to the soil, and how rapidly the organic matter is broken down to humus. Moisture and temperature control the rate of some soil-forming processes, such as weathering, the release of mineral constituents, and the translocation of the products of weathering. Climate affects the degree of horizon development in the soil and the properties of the horizons.

Many of the soils in the survey area are dry from July to October. During this period temperatures are optimal for chemical and biological activity. Because of the dryness, however, soil-forming processes are retarded. During late spring, when soil moisture is optimal for chemical and biological soil-forming processes, the soils are cool. Leaching is very effective in these soils, but the rates of weathering and organic matter decomposition are slowed. Many of the soils in the survey area have properties that reflect these climatic conditions.

At the higher elevations, the annual precipitation averages 40 inches or more and the mean annual air temperature is about 38 degrees F. Conto soils, which are at these elevations, have a spondaic horizon. The spondaic horizon has a high content of organic matter and active aluminum compounds, has bright reddish hues, and varies in thickness. These soils formed in glacial till mantled with volcanic ash and loess.

Living Organisms

Plants, animals, and micro-organisms determine the rate and character of certain soil-forming processes. Plants add organic material to the soil. As it decomposes, this material darkens the mineral surface layer and promotes granular structure. Plants cycle nutrients through the soil, protect the soil against erosion, and control water movement in the soil. Certain micro-organisms and plants form a symbiotic relationship, take nitrogen from the air, and add the nitrogen to the soil in a form that supports biological activity in soils.

The influence of plants on soil formation is expressed as differences in morphological properties of the surface layer. Grasses contribute a considerable quantity of organic material directly to the soil in the form of roots. Residue from grass leaves and stems is returned to the surface. This relatively large volume of organic material decomposes throughout the root zone and forms a thick, dark, fertile A horizon. In contrast, coniferous trees deposit a large quantity of acidic litter on the surface in the form of needles, bark, and wood. This litter decomposes slowly through the action of fungi and other micro-organisms. Soils that formed under forests have a pronounced 0 horizon and a surface layer that is either thin and dark or leached and light colored, and

soils that formed under grasses have a thick, dark surface layer.

In this survey area, grassland, woodland having a grass under story, and woodland are broad vegetative associations. Brickel soils and other Moll sols formed under grasses. Typically, they have a grayish brown A horizon that is 10 to 18 inches thick. They have good structure, which improves permeability and the development of roots.

Typically, the soils that formed under trees and grass under story have properties that are intermediate between those of soils that formed only under grasses and those that formed only under trees. The surface horizon of these soils is thinner and lighter colored than that of grassland soils. Typically, the A horizon ranges from 4 to 12 inches in thickness. These soils are Inceptisols and Mollisols. Inkler. Kaniksu, and Usk soils are examples.

Typically, the soils that formed under dense, coniferous forest where the under story vegetation is sparse have a light colored surface layer. Some of these soils have a thin, leached surface layer that formed in volcanic ash. They do not have a leached layer in some disturbed areas. These soils are Inceptisols. Hartill, Moscow, and Waits soils are examples.

Soil horizons can be destroyed or mixed by plants and animals. Under natural forest succession, trees die in place or are blown down. These processes move or displace considerable volumes of soil. Burrowing animals, earthworms, and ants move and sort soil material. In some forested soils an Al horizon formed because of earthworm activity. Generally, the morphological features resulting from biological activity are beneficial.

Human activities influence soil formation and soil properties. Cultivation physically alters the surface layer and changes the fertility of virgin soils. Incorporating organic matter and other soil amendments changes basic chemical properties, such as pH, base saturation, and nutrient status. Other soil properties that are altered by human activities include color, structure, and permeability. Logging mixes surface litter and duff with a mineral surface layer, and clear-cutting allows grasses and shrubs to invade and grow. These activities favor the development of a dark A horizon. Cultivation and logging can accelerate erosion on the steeper convex slopes and thus increase the extent of deposition on the concave lower slopes.

Topography

Topography directly influences the formation of soils through its effects on soil moisture, soil temperature, the rate of geologic erosion and redeposit ion, the amount and type of vegetation that grows on the soil, runoff, pending, and the formation of frost pockets. Topography indirectly influences the formation of soils through its effects on wind currents and the fallout that results in the accumulation and layering of airborne parent material, such as loess and volcanic ash. Slope, landscape position, relief, and aspect are important elements of topography.

Landscape position influences soil formation through its effects on the accumulation of parent material. Rathdrum soils, for example, formed in thick deposits of volcanic ash that was eroded from the higher positions on the landscape and was redeposit in the lower positions. Soils in surrounding landscape positions have a thin admixture of ash and loess in their surface layer.

Relief influences soil formation through its effects on the accumulation and layering of parent material. The differences between Manley and Newbell soils exemplify this influence. The Manley soils formed on concave northern aspects above an elevation of 4,500 feet. The Newbell soils formed on convex slopes at the lower elevations. The surface layer of volcanic ash is more than 14 inches thick in the Manley soils but is only 7 to 14 inches thick in the Newbell soils.

Aspect, which determines the exposure to sun and wind, influences soil formation in the survey area through its effects on the accumulation of volcanic ash, soil moisture, and soil temperature. Differences in these effects can occur within short distances. South-facing slopes receive more direct radiation than north-facing slopes; therefore, they are warmer and drier. Raisio and Usk soils, which support open stands of ponderosa pine and Douglas fir, are on warm, dry southern exposures. They have a thick, dark surface layer that has little volcanic ash. Newbell and Aits soils also are forested and are at elevations similar to those of the Raisio and Usk soils, but they formed on northern or "protected" exposures. They have a thin, light colored mantle of volcanic ash.

The effects of aspect also are evident at the highest elevations, where the climate is cool and moist. Conifers grow on northern aspects, and grass grows on some southern aspects. In spring, snow remains on the northern aspects several weeks longer than on the southern aspects and the rate of evaporation is lower on the northern aspects. As a result, soil moisture is more effective in translocation carbonates, iron and aluminum oxides, and the decomposed products of organic litter on the northern aspects. Manley soils, which are on northern aspects, have an acid, leached surface layer and a bright colored subsoil. Brickel soils, which are on the warmer southern aspects, have a less acid, dark surface layer.

Time

Time is needed for climate, vegetation, animals, and topography to transform the parent material into a soil. Over time, parent material that was initially uniform develops layers, or soil horizons. These horizons have properties that reflect the extent of the rooting of plant: and the downward movement of water and heat into the soil. Soils tend to form more horizons and develop different types of characteristics in those horizons as time passes. By most standards, the soils of the survey, area are youthful because they exhibit little genetic horizon differentiation.

In the glaciated parts of the survey area, the parent material has been exposed to soil-forming processes for a relatively short period. The maximum length of time indicated by fallout patterns of tephra from Glacier Pea is about 12,000 years. Mount Mazama ash, estimated to be 6,600 years old, forms a distinctive cap over the more protected parts of the uplands and makes up a portion of the surface layer of soils in lower positions.

Soils having a considerable content of clay in the parent material have had sufficient time for some of the clay to be moved from the A horizon to the B horizon. Cusick, Anglen, and Martella soils are examples. Conto soils have a spodic B horizon. Most of the other soils in the survey area have had too little time for the formation of an argillic or spodic horizon. These soils have a cambic horizon that shows little evidence of development other than color and structure.

Blueslide, Kegel, and other soils on flood plains periodically receive sediments from the uplands. They are very young and show little evidence of horizon differentiation other than a dark A horizon, which is inherited from the material eroded from soils on the surrounding uplands.

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Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Animal-unit-month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 2
Low	2 to 3.75
Moderate	3.75 to 5
High	5 to 7.5
Very high	more than 7.5

Back slope. The geomorphic component that forms the steepest inclined surface and principal element of many hillsides. Back slopes in profile are commonly steep, are linear, and may or may not include cliff segments.

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter

measurements are ordinarily taken.

Brush management. Use of mechanical, chemical, or biological methods to reduce or eliminate competition from woody vegetation and thus to allow understory grasses and forbs to recover, or to make conditions favorable for reseeding. It increases forage production and thus reduces the hazard of erosion. Brush management can improve the habitat for some species of wildlife.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Canyon. A long, deep, narrow, very steep-sided valley with high, precipitous walls in an area of high local relief.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Cement rock. Shaly limestone used in the manufacture of cement.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation by use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control wind erosion.

Cirque. Semicircular, concave, bowllike areas that have steep faces primarily resulting from glacial ice and snow abrasion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed.

Coarse fragments. Mineral or rock particles larger than 2 millimeters in diameter.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is more than 60 percent.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Compaction, soil. An alteration of soil structure that decreases the extent of voids and increases bulk density. It ultimately can affect biological and chemical properties.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Conglomerate. A coarse grained, clastic rock composed of rounded to subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. If soil-improving crops and practices

used in the system more than offset the soil-depleting crops and deteriorating practices, then !t is a good conservation cropping system. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.-Noncoherent when dry or moist; does not hold together in a mass.

Friable.-When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.-When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Weakly smeary.-When moist, the soil material changes to fluid, the fingers skid, and the soil feels greasy under moderate pressure between thumb and forefingers.

Plastic.-Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.-Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.-When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.-When dry, breaks into powder or individual grains under very slight pressure.

Cemented.-Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming. A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.-These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.-These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of

crops can be grown and yields are low.

Well drained.-These soils have an intermediate water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.-These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of some field crops are adversely affected unless a drainage system is installed. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.-These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless a drainage system is installed. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.-These soils commonly are *so wet* at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.-These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except rice) unless a drainage system is installed.

Drainage, surface. Runoff, or surface flow of water, from an area.

Draw. A small stream valley, generally more open and with broader bottom land than a ravine or gulch.

Duff. A term used to identify a generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature; for example, fire that exposes the surface.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Extrusive rock. Igneous rock derived from deep-seated molten matter (magma) emplaced on the Earth's surface.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after *a soaking rain; also called normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. Area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of people and equipment in fire fighting. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material is 35 to 60 percent flagstones, and extremely flaggy soil material is more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (or 300 meters) and fringes a mountain range or high-plateau escarpment.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard rock. Rock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head out. To form a flower head.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

O horizon.-An organic layer of fresh and decaying plant residue.

A horizon.-The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.-The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

E horizon.-The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

C horizon.-The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.-Soft, consolidated bedrock beneath the soil.

R layer.-Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are: *Basin.-Water* is applied rapidly to nearly level plains surrounded by levees or dikes. *Border.-Water* is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
Controlled flooding.-Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
Corrugation.-Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.
Drip (or trickle).-Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe. *Furrow.-Water* is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.-Water is sprayed over the soil surface through pipes or nozzles from a pressure system. *Subirrigation.-Water* is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
Wild flooding.-Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand or loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Mean annual increment. The average yearly volume growth of a stand of trees from the year of origin to the age under consideration.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure,, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance-few, *common,* and *many, size-fine, medium,* and *coarse;* and contrast-faint, *distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Mountain. A natural elevation of the land surface, rising more than 1.000 feet above surrounding lowlands, commonly of restricted summit area (relative to a

plateau) and generally having steep sides and considerable bare-rock surface. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of three simple variables-hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Observed rooting depth. Depth to which roots have been observed to penetrate.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Post and piling outlet. A market location where posts and pilings are bought, processed, and sold.

Potential native plant community. See Climax plant community.

Prescribed burning. The application of fire to land under such conditions of weather, soil moisture, and time of day as presumably will result in the intensity of heat and spread required to accomplish specific forest management, wildlife, grazing, or fire hazard reduction purposes.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and

maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Reforestation. The establishment of planted or naturally occurring tree seedlings in an area that was once forested; also includes the physical acts associated with planting tree seedlings in the ground. The expected period needed for natural reforestation is described by the terms readily, periodically, and infrequently. *Readily* indicates that seedlings are expected to occupy the area in 2 to 5 years; *periodically,* in 5 to 10 years; and *infrequently,* in 10 to 20 years.

Regolith. The unconsolidated mantle of weathered rock and soil material on the Earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saprolite (soil science). Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand: shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Seral. Refers to species or communities that are eventually replaced by other species or communities within a sere.

Sere. All temporary communities in a successional sequence.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling

can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site class. A grouping of site indexes into five to seven production capability levels. Each level can be represented by a site curve.

Site curve (50-year). A set of related curves on a graph that shows the average height of dominant trees for the range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant trees that are 50 years old or are 50 years old at breast height.

Site curve (100-year). A set of related curves on a graph that shows the average height of dominant and codominant trees for a range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant and codominant trees that are 100 years old or are 100 years old at breast height.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Skidding. A method of moving felled trees to a nearby central area.

Skid trails. The paths created by skidded logs and the bulldozer or tractor used to pull them.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey the following slope classes are recognized:

Nearly level	0 to 3 percent
Gently sloping	3 to 7 percent
Moderately sloping	7 to 15 percent
Moderately steep	15 to 30 percent
Steep	30 to 40 percent
Very steep	40 percent and higher

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soft rock. Rock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the Earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil puddling. A condition caused by exertion of mechanical force that destroys soil structure by compression and shearing and results in the rearrangement of the soil particles to a massive or nonstructural state. It occurs in certain soils when they are wet. It generally accompanies the compaction process.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stand density. The degree to which an area is covered with living trees. It is generally expressed in units of basal area per acre, number of trees per acre, or the percentage of ground covered by the tree canopy as viewed from above.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 6 to 15 inches (15 to 38 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Talus. Rock fragments of any size or shape, commonly coarse and angular, derived from and lying at the base of a cliff or very steep, rock slope. The accumulated mass of such loose, broken rock formed chiefly by falling, rolling, or sliding.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the

Earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow hazard. The likelihood that trees will be blown over by the wind and partially or completely uprooted. The predicted severity of windthrow is described by the terms occasionally and frequently. *Occasionally* means that as much as 5 percent of the trees in a stand may be blown down during periods of excessive wetness and moderate or strong winds. The hazard of windthrow is moderate. *Frequently* means that more than 5 percent of the trees in a stand may be blown down during periods of excessive wetness and moderate or strong winds. The hazard of windthrow is severe.

Yarding paths. The paths created by cable-yarded logs as they are pulled up or down a hill to a nearby central area.